DYNEX
TECHNOLOGIES
The Microtiter® Company

DSX™ Automated ELISA System

Operator's Manual

IMPORTANT
Please read carefully before using the DSX

Part No. 91000060 Version 07-2000

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Questions or comments regarding the content of this manual can be directed to the address below or to your supplier.

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About this Manual

This manual has been written for laboratory technicians and provides detailed instructions for using the *DSX™ Automated ELISA System*.

This manual gives you the information needed to:

- Install the *DSX™*
- Set up the *DSX™* to suit your specific application requirements
- Understand the *DSX™* menus
- Run assays using the *DSX™*
- Create or modify assays
- Perform required preventive maintenance
- Service the *DSX™*
- Review safety precautions

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Chapter 1 Overview

Introduction

The *DSX™ Automated ELISA System* (Figure 1) is a computer-controlled microplate processing system that fully automates ELISA assays. The DSX System automates the sample distribution, incubation, reagent addition, washing and detection phases of microplate assays. It is intended for use in clinical, research and industrial laboratories.

The DSX is an automated system that is useful for medium throughput, multiple assay applications. The system is designed to process specimens in a continuous flow from sample to result. Operator attendance is normally not required once a run has started.

Samples

A run can contain up to 96 samples. Serum and/or plasma specimens are generally used for clinical testing, although other fluids such as urine or spinal fluid can be run. Specimens containing large particulate matter, such as stool, tissue homogenates or culture media, can also be used. It is recommended that these specimens are processed through a mesh filter prior to loading onto the system to assure sample homogeneity and pipetting precision.

A wide variety of standards or control samples can also be run. Standards or controls are loaded onto a separate rack that contains up to 33 standard/control tubes. The tubes are available from your supplier.

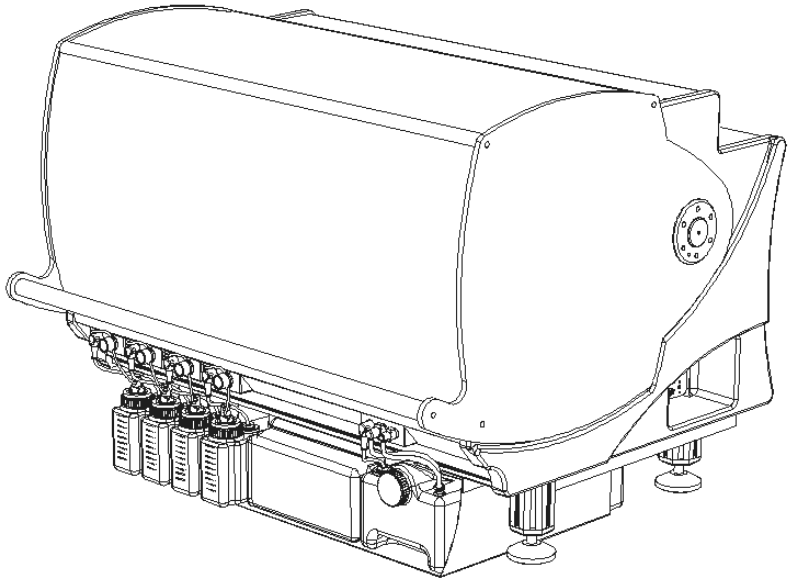

Figure 1. The *DSX™ Automated ELISA System*

Reagents

The DSX System utilizes a single reagent rack that contains up to 24 bottles. The required reagent bottles are available from your supplier.

Pipetting

Pipetting of samples, standards/controls and reagents is performed using custom-designed disposable pipette tips to assure pipetting precision and eliminate possible cross-contamination. Reagent tips pipette from 25 µL to 1 mL of reagents, and sample tips pipette from 5 µL to 300 µL of samples or standards/controls.

Dilutions

The DSX System will perform single-stage or multi-stage dilutions of sample. Dilutions ranging from 1:2 to 1:40,000 can be performed, using deep-well dilution plates on the system for dilutions above 1:60.

Incubation

Up to four temperature-controlled plate incubators may be present. Each incubator can be set at a temperature ranging from ambient plus 7 °C to 50 °C, and each plate can be shaken during incubation. The particular incubator modules that are used during a worklist, the temperature of each incubator, and the shake parameters are automatically set by the system when the worklist is created.

Washing

Eight wells in one column of a 96-well plate can be washed simultaneously. Washing protocols can be defined so that all of the columns are washed in the same manner, or different wash cycles can be applied to specified columns on a plate.

A wide variety of user-defined wash protocols can be programmed on the system. In addition, different plate types can be accommodated.

Detection

During operation, each microplate is automatically transferred to the absorbance module at the appropriate time. The optical densities of the wells specified during assay definition are read, the various calculations (for example, blanking, QC of raw data, threshold or curve fitting) are applied, and the calculated results for the microplate are reported.

Features

The *DSX™ Automated ELISA System* has a number of performance and convenience features. These are summarized below:

- Different assays can be run on the same plate
- ESP™ (Electronic Signature Pipetting) for liquid level and clot detection
- Endpoint data analysis to perform qualitative and quantitative data reduction
- Less than 10 second reading time (using single wavelength)
- On-board self diagnostics
- Selection of up to six filters
- Single, dual and multiple wavelength reading modes
- Easily removable incubator, wash, and absorbance modules for servicing
- Small footprint
- A variety of wash protocols can be programmed
- A variety of plate types can be programmed
- Liquid level sensing on Waste Container and Wash Buffer Containers
- Quick dispense
- Aspirating/pipetting speed can be changed for viscous liquids

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Chapter 2 Description

Hardware Components

Locations of the principal hardware components of the *DSX™ Automated ELISA System* are shown in Figure 2.

Indicator Light

The system contains an indicator light (Figure 3) that is illuminated whenever the system power is ON.

***CAUTION**: Power is on to the system and to the incubator heaters whenever the indicator light is illuminated. A thermal hazard is present.*

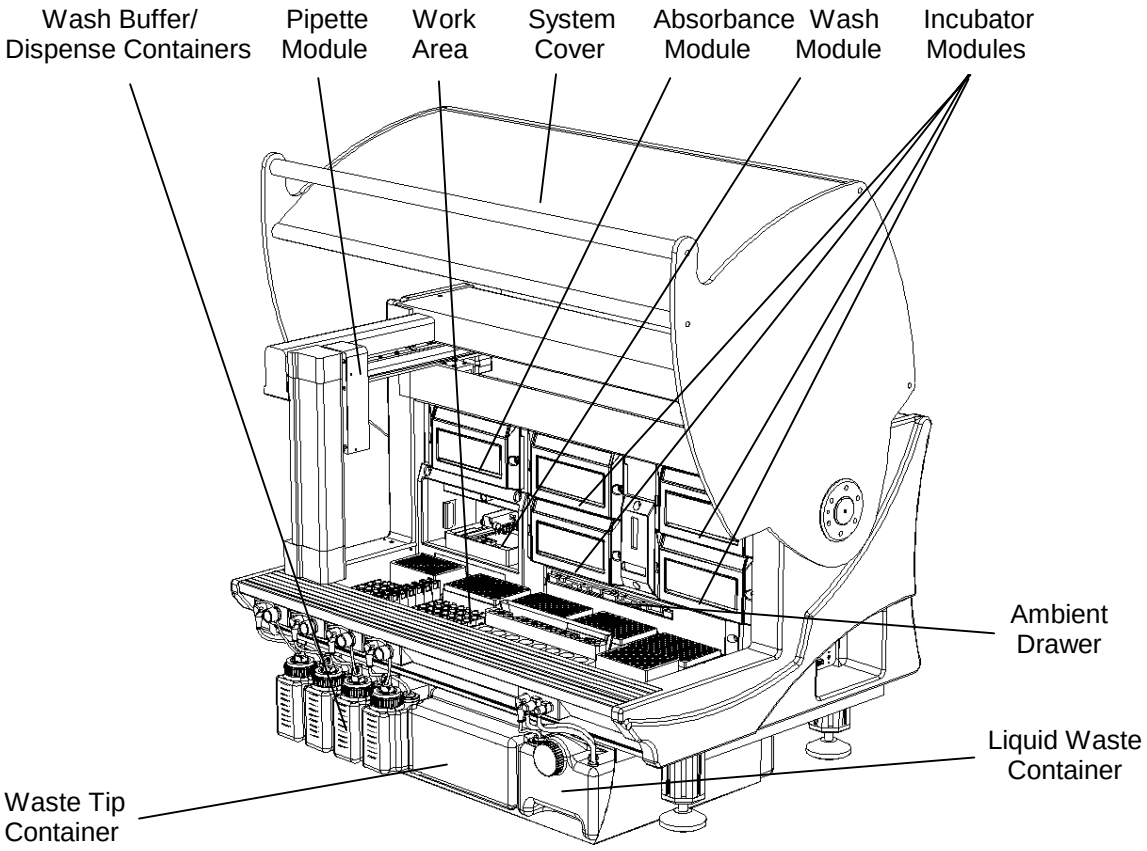


Figure 2. Location of Principal Hardware Components

System Cover

The **system cover** encloses the workspace and pipette module. The cover must be closed during operation to prevent the pipette module from accidentally contacting an operator or bystander. An electrical interlock prevents operation of the pipette module when the system cover is open.

***CAUTION**: The electrical interlock for the system cover prevents accidental contact with the pipette module and/or robotic arm. Never disable the interlock unless instructed to do so by DYNEX personnel.*

To open the cover, lift the handle until the cover is in the upright position (Figure 3). The cover will remain in this position until it is closed.

To close the cover, push down on the handle until the cover is fully closed and locked. The system cover rests on the **cover stop** when it is fully closed.

***CAUTION**: Pinching hazard. Be sure that your hands and fingers are clear of the cover stop when closing the system cover.*

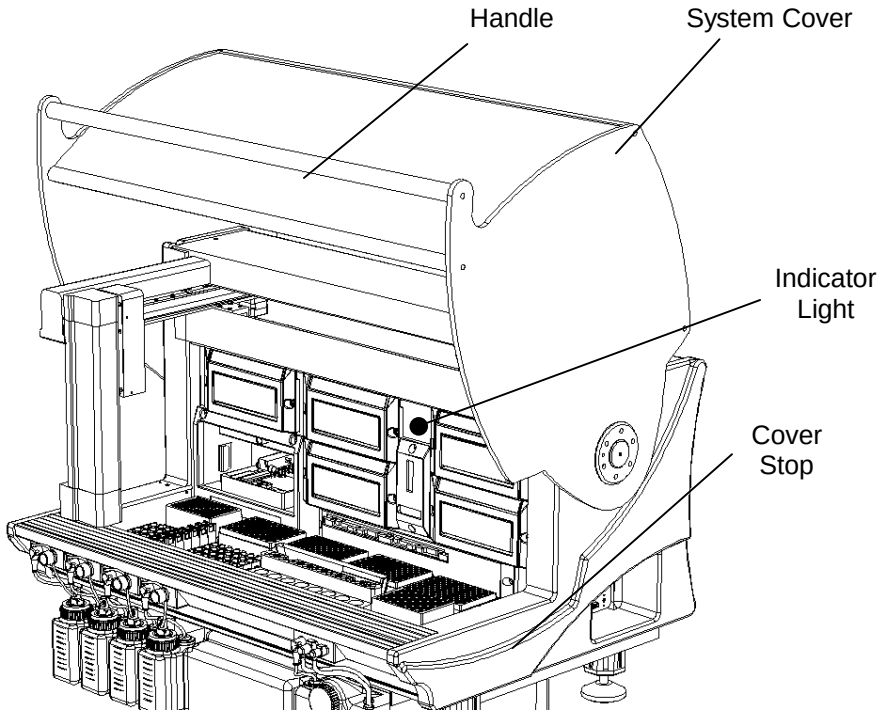


Figure 3. System Cover

Workspace

Samples, reagents, standards and controls, and consumables are loaded onto the **workspace**. Their locations are shown in Figure 4.

Sample tubes are contained in seven **sample racks**. Each sample rack contains 14 tubes and, although up to 98 samples can be contained on the system at one time, 96 sample tubes are used in routine operation. The seven sample racks are contained in a **sample caddy**. Since different sample tubes can be used on the system, the user must specify the sample tube dimensions before the tubes can be used.

Standards or controls are contained in the **control rack**, which contains up to 33 standard/control tubes. A specific 1.5-mL tube is required for standards or controls. The tubes can be obtained from your supplier.

Sample tips used for pipetting samples and standards/controls are contained in four **sample tip racks**. Each rack contains 108 sample tips, and a total of 432 sample tips can be loaded on the system. A specific sample tip is required and can be obtained from your supplier.

Reagent tips used for pipetting reagents are contained in a **reagent tip rack** that contains 41 reagent tips. A specific reagent tip is required and can be obtained from your supplier.

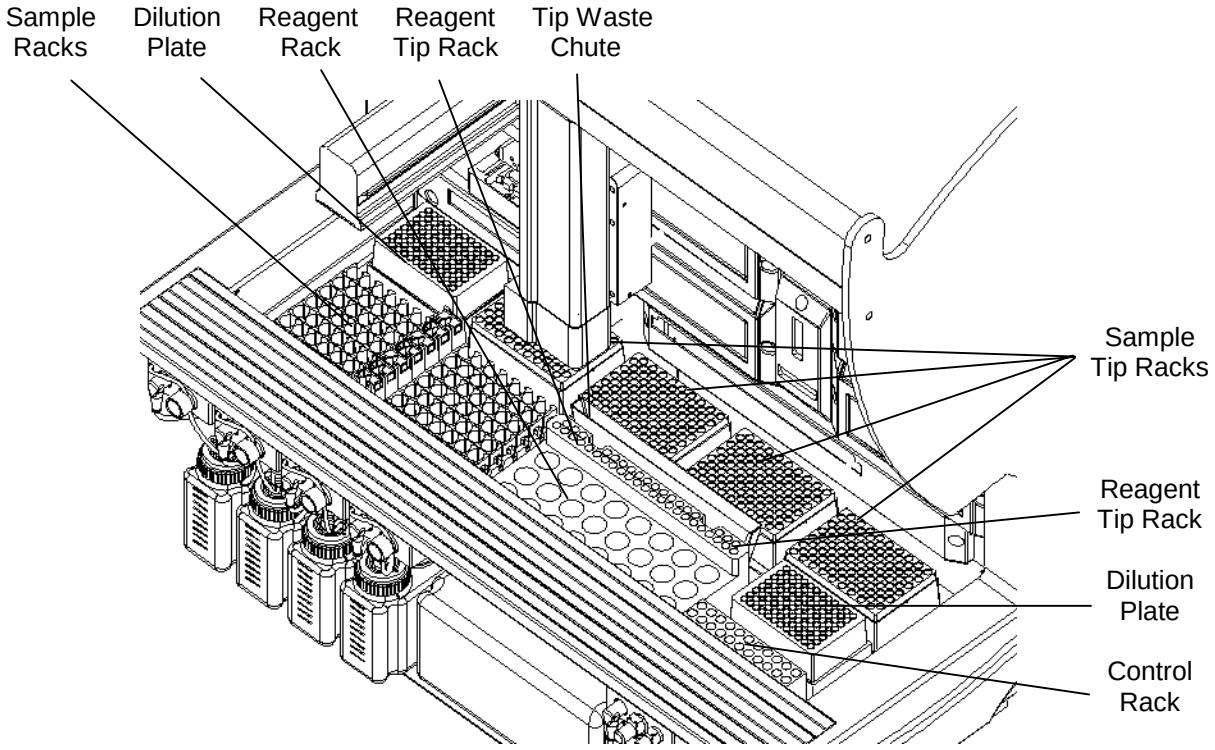


Figure 4. The Workspace

Reagent bottles are contained on the **reagent rack**, which contains up to 24 reagent bottles. A specific 25-mL reagent bottle is required and can be obtained from your supplier.

Two deep-well **dilution plates** can also be loaded. The dilution plates are used for two-stage (external) dilutions ranging from 22:1 to 1:36,100.

After a sample tip or reagent tip has been used, the pipette module moves over the **tip waste chute** and releases the tip. The tip waste chute directs the used sample tip or reagent tip into the waste container.

Ambient Drawer

The ambient drawer is used to store microplates when room temperature incubation in the dark is required. The ambient drawer will extend into the work area during pipetting.

When setting up a worklist, the plate carrier is extended from the ambient drawer (Figure 5), **plate holders** (see the following page) are placed in each of the ambient drawer positions, and the required microplates are placed onto the plate holders.

☞ *The microplate positions are numbered from **1** to **4**. Refer to page 59 for a summary of the procedure to prepare a worklist.*

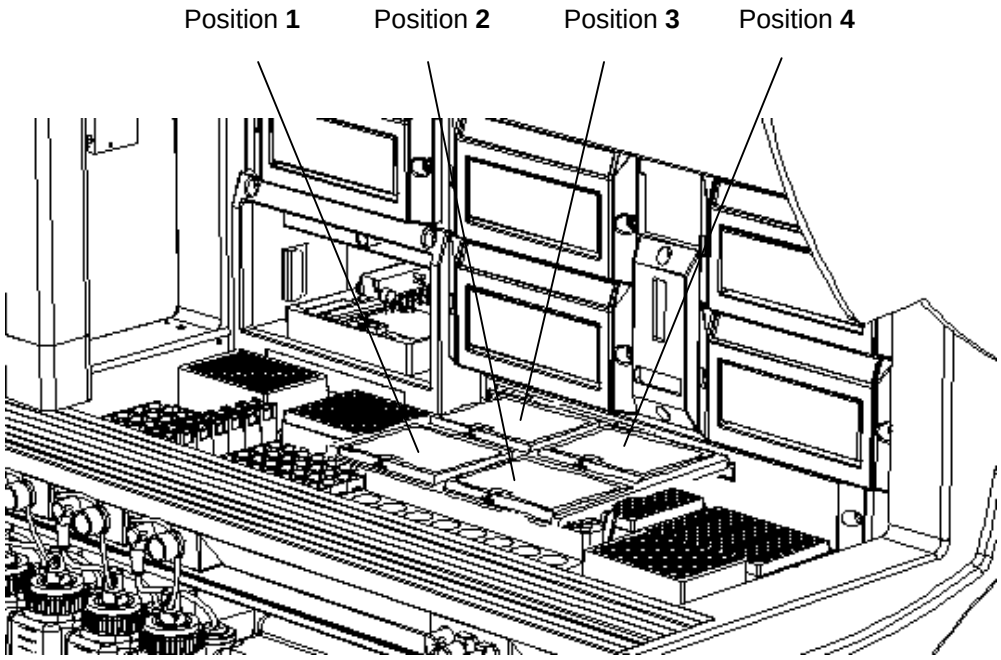


Figure 5. The Ambient Drawer

Plate Holders

Plate holders (Figure 6) allow the pipette module to transfer a microplate between modules.

Each plate holder has a pickup feature which the pipette module uses to transfer a microplate.

☞ *Whenever this manual refers to a microplate, it is implied that the microplate is seated in a plate holder .*

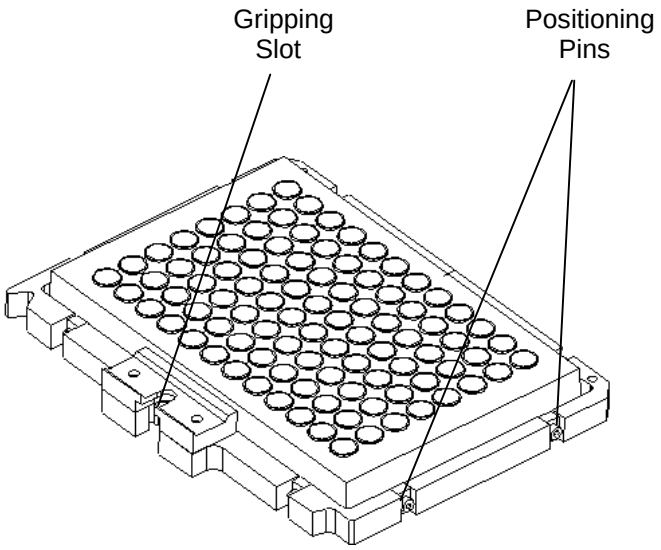


Figure 6. Plate Holder

Pipette Module

The **pipette module** is used to transfer microplates, to pipette samples, controls and standards, dispense reagents, and to perform dilutions. The pipette module travels in the *x*-, *y*- and *z*- directions to access the samples, controls, reagents, microplates and consumables on the workspace. The pipette module is shown in Figure 7.

The pipette module has the following functions:

Function	Purpose
Microplate Handling	The **microplate handler** transfers a microplate between the ambient drawer, an incubator module, the wash module and the absorbance module by gripping the microplate holder, moving it to its new location, and releasing it.
Pipetting (automatic liquid level sensor)	The **pipettor** pipettes samples or standards/controls using disposable sample pipette tips. Dispenses reagents using disposable reagent pipette tips. Each pipette tip is automatically discarded into the waste bin after use. A new pipette tip is obtained from a sample tip rack or the reagent tip rack when it is needed.
Tip Ejection Detection	Verifies that a used tip was ejected before obtaining a new tip.

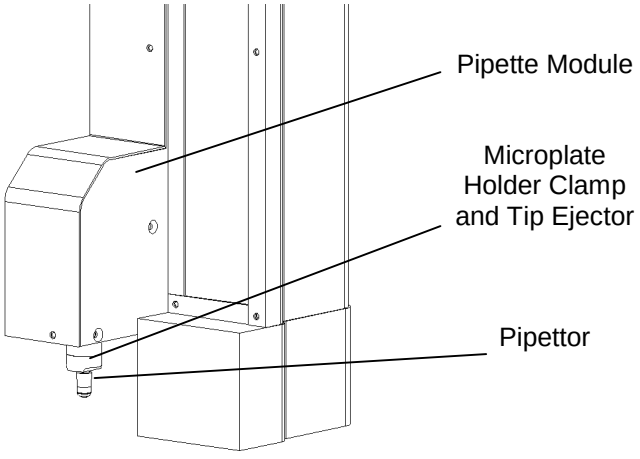


Figure 7. The Pipette Module

Separate **pipetting profiles** ranging from **1** to **5** can be specified for any fluid except wash buffer. The pipetting profile specifies the rate at which fluids are aspirated or dispensed from the pipette tip.

The pipetting system of the *DSX™ Automated ELISA System* includes ESP™ (Electronic Signature Pipetting) software for automatic detection of clots, foam, or bubbles when pipetting samples. The pipeting signature observed when pipetting each sample is compared to nominal pipetting signatures of particular sample types (for example, serum or plasma) obtained during system configuration. If the pipetting signature does not fall within the normal range of pipetting profiles for that sample type, the system records an error.

***CAUTION**: Changing the pipette profile can affect accuracy and precision of an assay.*

*The default pipetting profile is **4**. The pipetting profile used for samples is specified during definition of worklist runtime parameters. Refer to page 61 for a summary. The pipetting profiles used for standards and controls are specified during definition of assay operations. Refer to page 29 for a summary.*

The pipetting signature is specified during definition of worklist runtime parameters. Refer to page 61 for a summary

Sample Mixing During Dilution

The user can program up to 9 dispense/aspirate mix cycles during dilution steps to achieve optimal mixing of samples during dilution.

Pre-Dilution

The *DSX™ Automated ELISA System* can perform a pre-dilution of samples before they are assayed. Pre-dilution can be performed in a single stage in standard microplates or in two stages using deep-well microplates. The system can be programmed to add diluent to a plate before or after the sample is added.

The dilution modes are described below:

Dilution Mode	Description
Microplate Dilution	Ratios of sample to diluent range from 11:1 to 1:59 (*e.g.* 5 µL sample combined with 295 µL of diluent to yield a 1:59 dilution.
Deep-well Plate Dilution	Ratios of sample to diluent range from 2:1 to 1:190 (*e.g.* 5 µL sample combined with 950 µL of diluent to yield a 1:190 dilution.
Deep-well Plate plus Microplate Dilution	Ratios of sample to diluent range from 22:1 to 1:11,210 (*e.g.* 5 µL sample combined with 950 µL of diluent in a deep-well to form a new sample from which 5 µL is combined with 295 µL of diluent in a microplate to yield a 1:11,210 dilution.
Deep-well Plate plus Deep-well Plate Dilution	Ratios of sample to diluent range from 4:1 to 1:36,100 (*e.g.* 5 µL sample combined with 950 µL of diluent in a deep-well to form a new sample from which 5 µL is combined with 950 µL of diluent in another deep-well to yield a 1:36,100 dilution.

Incubator Modules

Microplates are incubated and shaken in the **incubator modules**. A maximum of four incubator modules are present, so that different microplates can be incubated at different temperatures with or without shaking. Incubation temperature and shake duration are specified during definition of an assay.

☞ ***Note**: Refer to page 29 for a summary of the procedures to define an assay. A microplate can also be incubated at ambient temperature without shaking by allowing it to remain in the ambient drawer for a specified period of time.*

The particular incubator modules that are used during a worklist and the temperature and shaking of each incubator are automatically set by the system when the worklist is created. Processing of the worklist will not commence until the temperature of each required incubator module is at the correct value.

☞ ***Note**: The incubator modules are labelled as **1**, **2**, **3** and **4** and are designated as such in the Revelation™ software. The incubator modules will control microplate temperature at any specified temperature ranging from ambient plus 7 °C to 50 °C.*

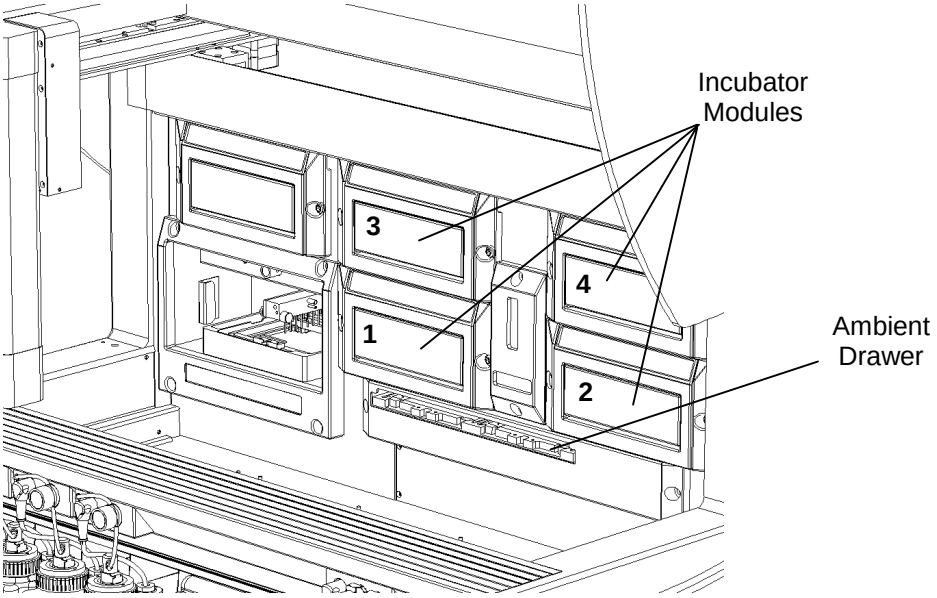


Figure 8. Incubator Modules

Wash Module

The well contents of a microplate are washed in the **wash module** (Figure 9). The wash module is designed to wash all 8 wells in one column of an 8 x 12 microplate simultaneously. The washing protocol can be defined to wash partially filled plates containing complete columns.

Different user-defined wash protocols can be contained on the system. In addition, the system can be configured with different plate types so that the wash head positions for each plate type can be specified. The system can accommodate flat-bottom, C-bottom, U-bottom and V-bottom types of microplates.

Note: Refer to page 29 for a summary of the wash protocol alternatives.

Wash Head

The wash head contains two sets of **wash pins**. The shorter pins (the **dispense pins**) dispense fluid and the longer pins (the **aspirate pins**) aspirate fluid. The aspirate pins and the dispense pins are closely spaced so that fluid can be aspirated from and dispensed into wells at the same time.

The wash pins are fixed to the wash head. During operation, the wash head assembly is lowered to insert the wash pins into the wells or raised to remove the wash pins from the wells. Lowering the wash head assembly allows the well contents to be aspirated or a bottom wash to be performed. Raising the wash head assembly allows the wash head to be moved so another column can be washed or so the wells can be filled.

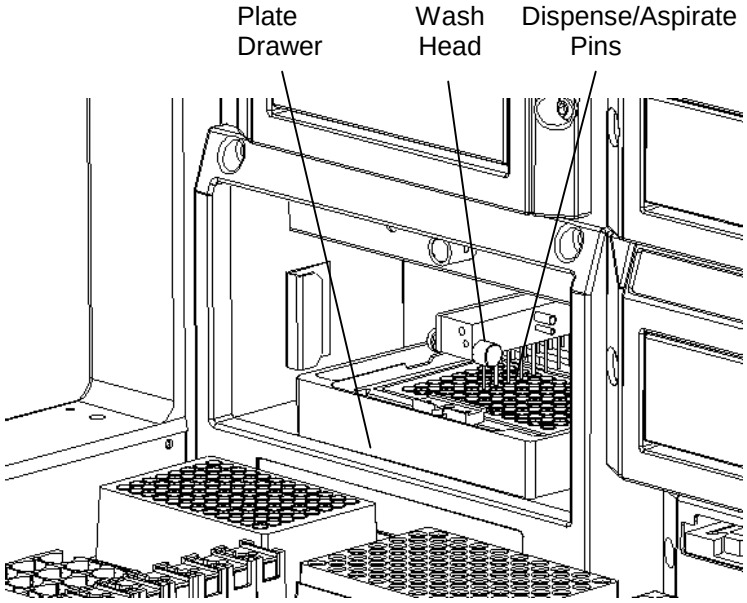


Figure 9. Wash Module

Wash Head Positions

The vertical positions that the wash head can assume (Figure 10) are described below. Each wash head position can be specified by the user to within 0.1 mm.

☞ ***Note**: Wash head positions for various plate types are specified during consumables management. See page 28 for additional information.*

Wash Head Position	Description
Dispense Height	Defines the position at which fluid will be dispensed. While it is often desirable to set this height just above the top of the well in order to form a positive meniscus, the user should ensure that an overflow does not occur.
Top of Well	Positions the aspiration pins so they are aligned with the top of the well. At this position, the liquid meniscus is removed from the top of the well.
Aspiration Height	Positions the aspiration pins at the bottom of the well so that the contents of the well can be completely aspirated.
Sweep Height	Raises the aspiration pins slightly above the Aspiration Height (see above) so that the aspiration pins can be moved back and forth in the well while the fluid is being aspirated without the danger of scratching the bottom of the plate.
Bottom Wash Height	Lowers the wash head to this height during **dispense** so that the force of the dispensed fluid can wash the bottom of the wells.
Sweep Stroke	Defines the horizontal motion used during a sweep operation to fully aspirate well contents.

☞ ***Note**: Select **No Sweep** for sweep mode and disable bottom washing whenever a C-bottom, U-bottom or V-bottom plate is being used.*

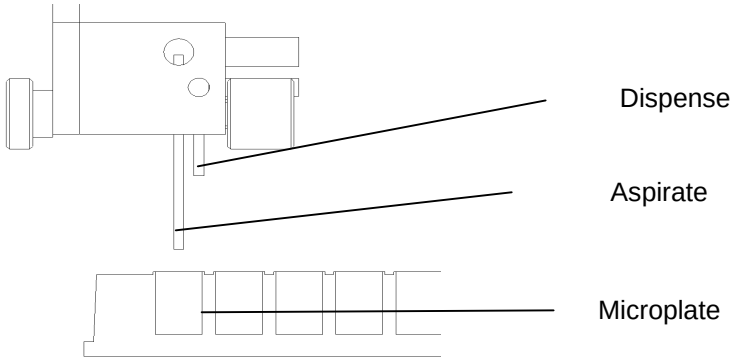


Figure 10. Position of the Wash Pins

Wash Protocol Operations

A wash protocol consists of a series of **Purge**, **Move**, **Soak**, **Aspirate**, **Dispense** and **Fill** operations. **Purge**, **Move** and **Soak** can be carried out in any sequence. **Aspirate**, **Dispense** and **Fill** can only be carried out within a **Move** operation, and there cannot be a **Move** within a **Move**.

Each of these operations is summarized below:

Operation	Description
Purge	Dispenses fluid from the dispense wash pins while the wash head is positioned over the purge tray. A purge is usually carried out at the beginning of a wash protocol or at the end of the day to rinse the dispense wash pins and remove air bubbles.
Move	Performs **Aspirate**, **Dispense**, **Fill** and/or **Soak** operations on specified strips of the Microplate.
Aspirate	Removes the contents of a well by positioning the wash pins at the aspiration height in the well and aspirating the liquid from the wells. A sweep may also be performed during **Aspirate**.
Dispense	Dispenses a specified amount of fluid into the wells after aspirating the contents of the wells. If a bottom wash is specified, the wash head is then lowered to the bottom wash position so that fluid will be aspirated from the bottom of the wells while fluid is being dispensed.
Soak	The contents of the wells are allowed to equilibrate for the specified number of seconds.
Fill	The wells are filled with a specified amount of fluid.

Wash Head Sweep Modes

Sweep modes specify whether the aspiration tip moves from side-to-side during aspiration. Five sweep modes can be used:

- No sweep
- Always sweep
- Sweep on last cycle only
- Always Super Sweep
- Super sweep last cycle only

☞ ***Note**: Select **No Sweep** for sweep mode and disable bottom washing whenever a C-bottom, U-bottom or V-bottom plate is being used.*

Plate Drawer

The plate drawer holds the microplate in a known position so that the wash pins are precisely positioned in the wells during various wash protocol operations. The plate drawer allows linear shaking of the plate.

Wash Buffer Containers

Up to four different washing and/or dispensing reagents are contained on the system in **wash buffer containers**. The wash buffer containers are located at the front of the instrument (Figure 11).

Each container contains up to two liters of wash buffer. Dispensing of wash buffer from a container is controlled by a submersible pump in the wash container, a dispense valve above the wash bottle, and a dispense valve located near the wash head. The specified wash buffer is dispensed into wells whenever a Dispense or Fill operation is specified in the wash protocol.

Each wash buffer container must contain at least 500 mL of wash buffer in order to be used.

☞ ***Note**: The particular wash buffer that is used and the Dispense, Fill or Purge operations are defined during assay definition. See page 57 for a summary of the procedures for assay definition.*

A **quick connect fitting** and a **level sensor/pump connector** allow easy removal of a wash buffer container from the system (Figure 12). Disconnect the wash line by pressing on the metal tab of the quick connect fitting and gently pulling up on the wash line to remove it. Disconnect the level sensor and pump connector by pulling it out of the connector socket.

Fill (or empty) a wash buffer container using the **filler cap** at the rear of the container.

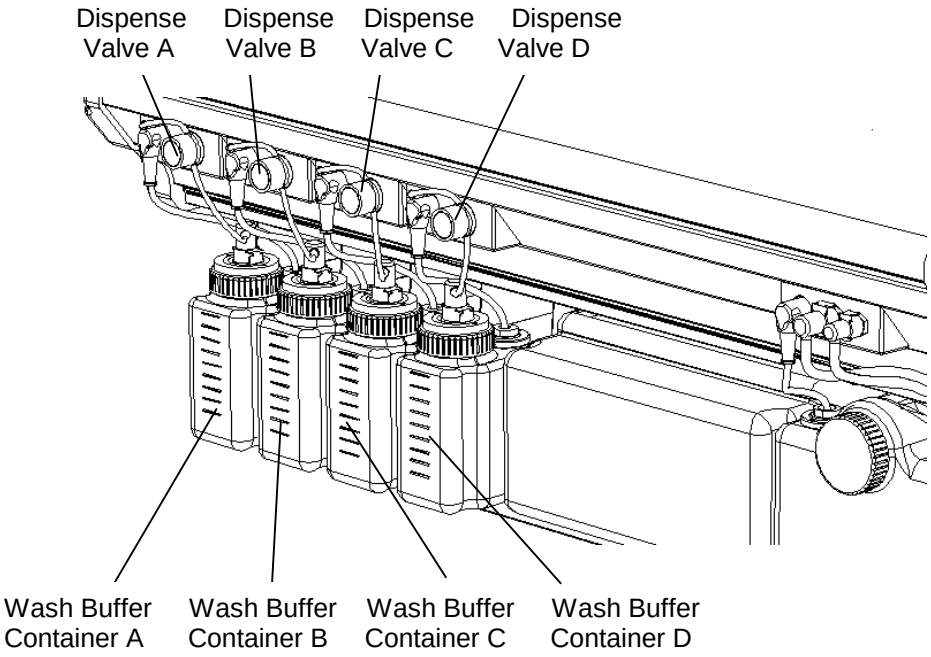


Figure 11. Wash Buffer Containers and Wash Buffer Dispense Valves

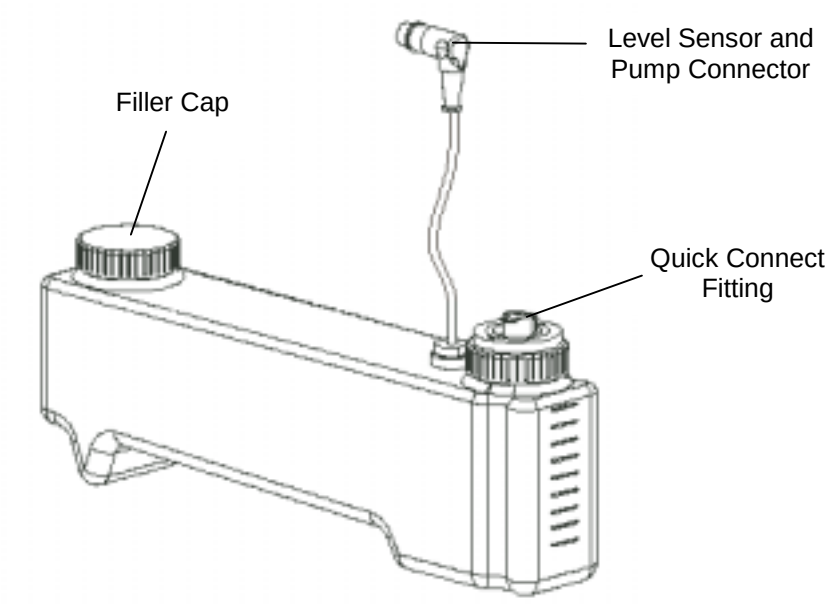


Figure 12. Wash Buffer Container Details

Waste Containers

Fluid that is removed during purging and washing is collected in the **liquid waste container**. Used sample and reagent pipette tips are disposed into the **tip waste container**. Both waste containers are located at the front of the instrument (Figure 13).

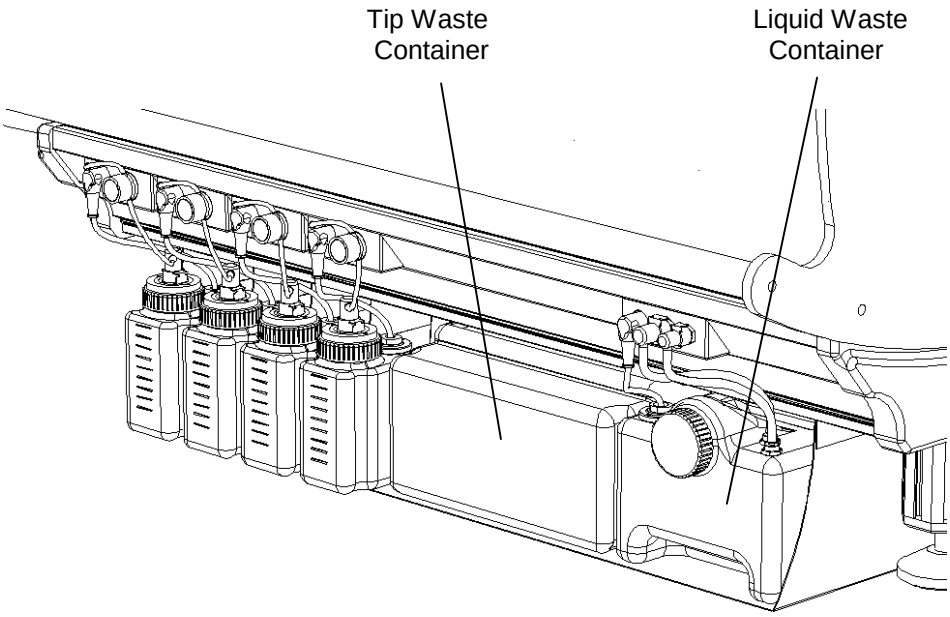


Figure 13. Waste Containers

The liquid waste container (Figure 14) holds up to eight liters of waste. A level sensor alerts the operator when the liquid waste container is full.

Two **quick connect fittings** connect the liquid waste and vacuum lines to the liquid waste container. Disconnect each fitting by pressing on the metal tab of the quick connect fitting and gently pulling on the line to remove it.

Disconnect the level sensor connector by pulling it out of the connector socket.

Empty the liquid waste container by removing the **waste cap** at the front of the container.

☞ ***Note**: Be sure that the waste cap is securely tightened. Otherwise, a vacuum leak will cause the software to create a vacuum error condition.*

☞ ***Note**: 10% (v/v) solution of household bleach in water is recommended as a disinfectant.*

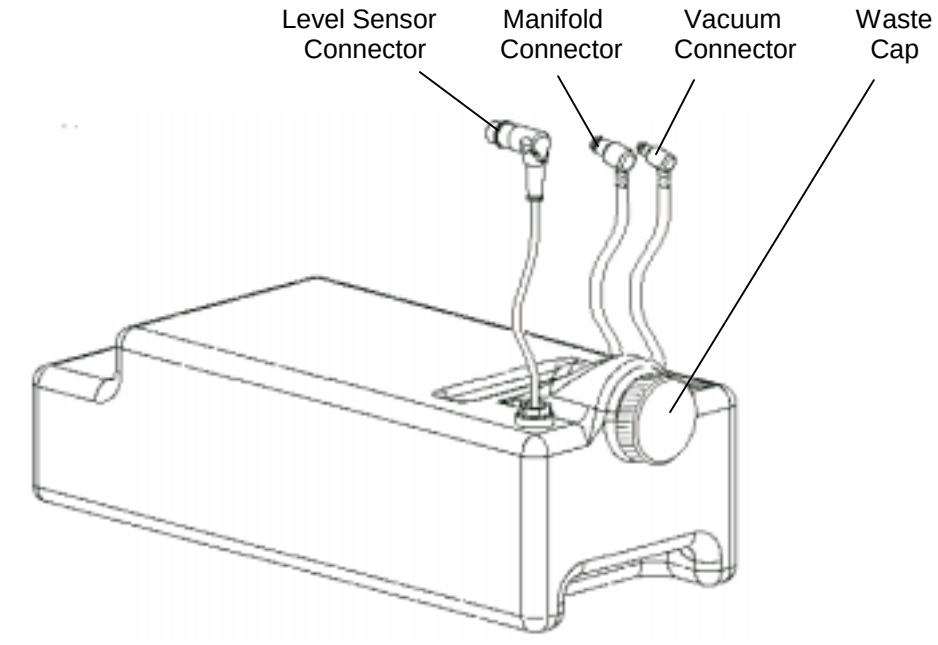


Figure 14. Liquid Waste Container

Absorbance Module

The **absorbance module** measures the optical density (OD) of the final reaction mixture in the microplate wells. The wavelength mode that is used and the wavelength(s) at which the optical density is measured are specified during assay definition.

☞ ***Note**: Procedures for specifying the wavelength mode and the wavelength(s) at which the optical density is measured are defined during assay definition. See page 57 for a summary of the procedures for assay definition.*

☞ ***Note**: The current version of Revelation™ software supports endpoint reactions.*

During operation, each microplate is automatically transferred to the absorbance module at the appropriate time. The optical densities of the wells specified during assay definition are read, the various calculations (for example, Blanking, QC Raw Data, Threshold or Curve Fitting) are applied, and the calculated results for the microplate are reported.

☞ ***Note**: Procedures for specifying the manner in which assay results are calculated and reported are defined during assay definition. See page 57 for a summary of the procedures for assay definition.*

The location of the absorbance module is shown in Figure 15.

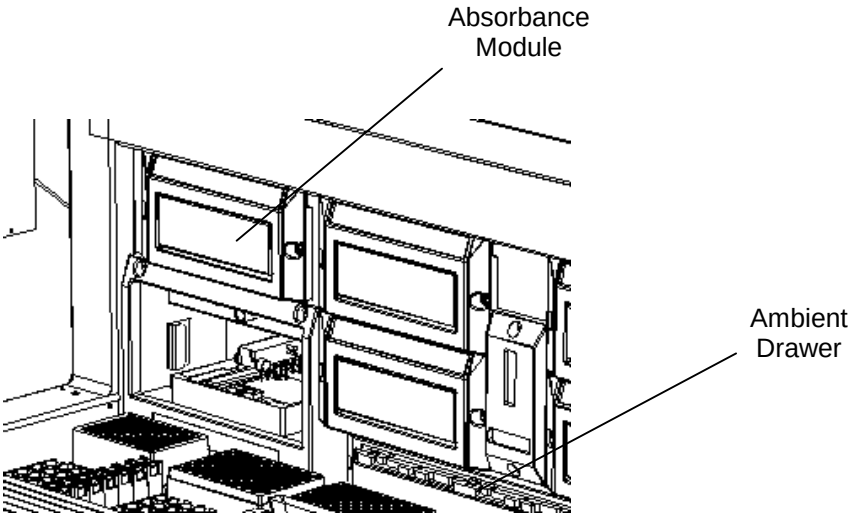
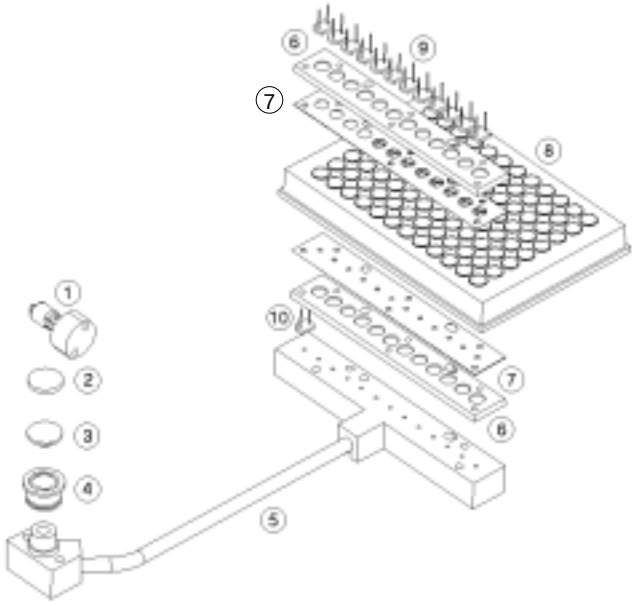


Figure 15. Absorbance Module

Optical Path

The optical path through the Absorbance module is shown in Figure 16. A tungsten halogen lamp projects a light beam through a heat absorbing filter and a lens. The beam is focused by the lens and passes through a filter (located on the filter wheel), which allows only light of the desired wavelength range to pass. The beam is then separated into 13 channels, one of which is used as a reference channel to monitor the light output of the lamp. The other 12 beams are directed upwards through a row of 12 wells on the microplate, onto an array of silicon photodiodes. The silicon photodiodes quantify the intensity of light transmitted through the reaction solution. Absorbance of the solution is measured in terms of optical density (OD) and the assay results are interpreted accordingly.



1	Lamp	6	Lenses
2	Heat Filter	7	Optic Stops
3	Lens	8	Microplate
4	Filter	9	Photodiodes
5	Optic Fibers	10	Reference Diode

Figure 16. Optical Path of the Absorbance module

Single and Dual Wavelength Modes

The Reader is able to take readings in three different modes:

- **Single**--using one test wavelength
- **Dual**--using one reference wavelength and one test wavelength
- **Multiple**--using a combination of wavelengths

The Single wavelength mode is sufficient for most applications.

The Dual wavelength mode can be used if it is necessary to reduce errors caused by dirt and scratches on the bottom of the wells.

The choice of test and reference wavelengths for the Dual Wavelength mode depends on the particular enzyme/substrate system being tested. However, the following rules should usually be followed:

1. The **test wavelength** (λt) should be at or near the maximum absorbance of the reaction product.

2. The **reference wavelength** (λr) should lie outside the absorbance band of the system but not far removed.

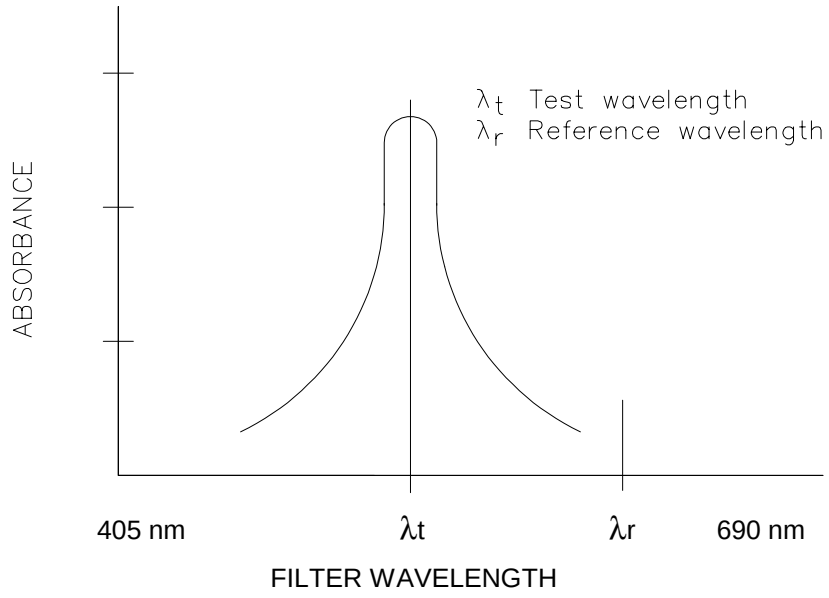


Figure 17. Dual Wavelength Selection

The Reader subtracts the absorbance at the reference wavelength (λr) from the absorbance at the test wavelength (λt) to minimize the effect of systematic errors.

If a test requires particular precision, you may specify test and reference filters of the same wavelength. The Reader will average the ODs produced using each filter, giving a more precise result.

Multiple Wavelength Mode

The Multiple wavelength mode reads samples at two different wavelengths and is used to obtain results where the peak absorbance is outside the optical range of the Reader.

The first reading (or the Primary mode) is at or near the peak wavelength. A second reading (or the Secondary mode) of the sample is then obtained at a wavelength that is within the absorbance region but not at the peak.

The Reader automatically uses the Primary mode reading when it calculates results. If, however, the absorbance in the Primary mode exceeds the detection limit of the Reader, the Secondary mode reading is used.

If the Secondary mode reading is used, the peak absorbance is calculated from the secondary mode reading using an algorithm that is selected by the user during configuration of the system.

Blanking

The Reader lets you subtract a reference value from all the ODs. It automatically uses air as a reference, but for certain applications other reference levels may be more appropriate.

For example, you may want to eliminate the absorbance of a reagent solution from the test result. The Reader can hold the OD of this reagent solution in memory and subtract it from all subsequently read ODs.

Blanks may be single wells, or an average of wells.

Software

Revelation™ software is used to control the DSX microplate processing system. The software automates the sample distribution, incubation, reagent addition, washing and detection phases of microplate assays. It also provides the user interface for configuration of the instrument and management of consumables (Figure 18).

The software includes an extensive menu of assay definition options that allow you to customize the readings, calculations, QC checks and results format for an assay.

Additional information about the software can be found in the *DSX* Online Operator's Manual, accessed by selecting the **Help** menu.

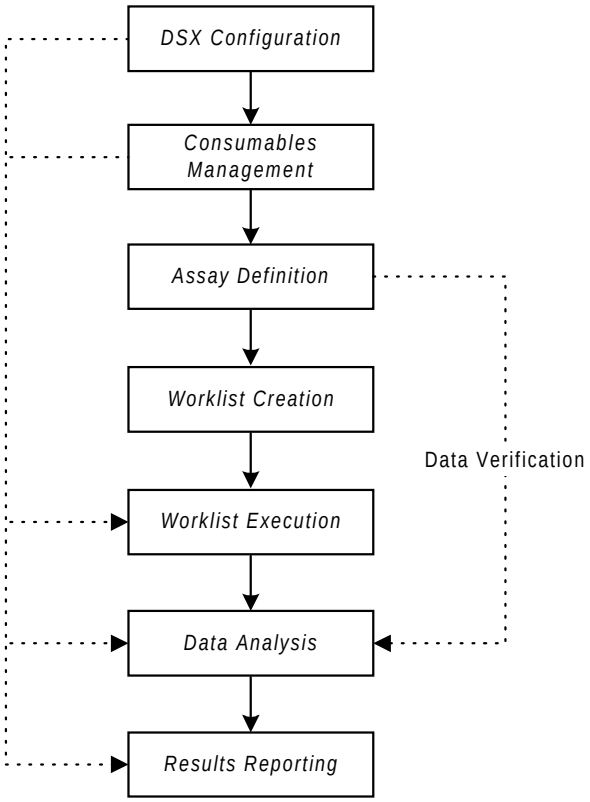


Figure 18. Revelation™ Software Overview

DSX Configuration

The DSX System can be configured for particular uses in your laboratory. Refer to Chapter 4 (*Preparing the System for Use*) for instructions.

The configuration options are summarized below:

Option	Description
Configure Reader	Define COM port, filters, conversion limits, maintenance scripts, and log file processing.
Select Fonts	Select the font to be used for printed results reports.
Set Options	Create short-cut buttons. Set default plate processing options, including auto save and auto print. Select the colors for different well types. Set default directories. Enter the laboratory name and address to be printed on results reports.
Assign a System Password	Change the default password in Revelation™ software.

Consumables Management

A database of all consumables and fluids is maintained in the software. Once a consumable or fluid is defined in the database, it can be selected from a drop-down list during definition of an assay.

Consumables and fluids are defined using the Tools menu. The fluids and consumables that are defined and the information that is entered for each are summarized below:

Consumable	Information Entered
Washer Fluids	Define the fluids that are used for washing and purging.
Sample Tubes	Define sample tubes and their specific dimensions.
Reagent/Diluent Fluids	Define reagents and diluents, and specify whether they are time-sensitive. If they are, specify the maximum on-system use time. Specify the pipette profile used when aspirating and dispensing a reagent or diluent. The profile should be set to **4** unless otherwise required.
Standard/ Control Fluids	Define standards and controls, and specify whether they are time-sensitive. If they are, specify the maximum on-system use time. Specify the pipette profile used when aspirating and dispensing a standard or control.
Washer Plates	Specify the height of the washer head for various washing positions (for example, well top height, dispense height and wash height) for each type of microplate that is used. Specify sweep modes that can be used during washing and their parameters. Specify whether bottom washing can be used during washing.

Assay Definition

The reagents, standards and controls that are used and the dilution, wash and incubation procedures for an assay are specified during assay definition. These options are defined using the Operations menu.

Arrangement of well types on the microplate, reading options, and procedures to be used for calculations, QC checks and reporting when running a test are also specified during assay definition. These options are defined using the Data Reduction menu.

The assay definition options are summarized below:

Option	Purpose
Operations Menu:	
Pipette Samples/ Standards/ Controls	Specify plate templates. Specify sample, standard or control volumes. Specify pipetting techniques and tip usage. Specify dilutions.
Dispense Fluid	Specify reagent volumes.
Wash Plate	Specify plate types, wash methods and wash buffer volumes. Specify details for the Purge and Clean cycles. Specify details for the Soak and Shake options.
Incubate Plate	Specify incubation time, temperature and shaking.
Data Reduction Menu:	
Data Reduction Wizard	Displays the Data Reduction dialog boxes in the order they appear on the menu, starting with Assay Title.
Assay Title	Specify assay title, author, code and password.
Reader Control	Specify assay wavelength(s), wavelength mode and shake.
Template	Specify the use (sample, control, blank, etc.) of each well on the plate, including the number of replicates, orientation, and fill direction.
Blank Mode	Select a pre-defined blank mode or define a custom blank mode.

Option (Cont'd)	Purpose
Data Reduction Menu:	
QC Raw Data	Define a quality control equation to be applied to the raw data obtained when running the assay.
Threshold	Define threshold equations, positive/negative Q.C. ranges, threshold Q.C. equations, and the results output format.
Curve Fit	Specify the parameters required to obtain quantitative results with a user-defined curve fit.
Ratio	Define the equation and output format required to report results as a ratio.
Spreadsheet	Perform arithmetic calculations on ODs from different wells. The results of these calculations are output as a matrix or table of data.
Report Options	Select report formats, matrix type, and export files.
Assay Options	Specify area statistics, processing order, and sample ID setup.

Worklist Creation

A **worklist** specifies the samples that are to be run. A worklist can include up to four microplates and multiple assays. More than one assay can be run on a plate if the assays have the same incubation, washing and shaking specifications.

***Note**: An assay must be created before it can be assigned to samples on a worklist.*

***Note**: The procedure for creating a worklist is summarized on page 59.*

Worklist Execution

Once a worklist has been created, the run can be started. The system prompts the operator to load any microplates and consumables that are required by the worklist.

***Note**: The procedure for running a worklist is summarized on page 61.*

Data Analysis

The optical density results for each well on each of the microplates in the worklist are analyzed according to the criteria that were specified during assay definition.

Results Reporting

When the processing of a microplate is completed, the results of the run are displayed on the screen.

Results files are automatically named **xxx.dat**, where **xxx** is the name you selected for the plate. Results are stored in the Plate Data directory.

***Note**: Select the **Options** command on the **Tools** menu to view or change a directory in which results files or other files are located.*

Data Backup

Revelation™ software allows the user to save all assays and worklists on floppy diskettes to avoid loss of data.

Required But Not Provided

Computer

A personal computer with monitor, keyboard, mouse and printer is required for operation of the *DSX™ Automated ELISA System*.

The computer system provides the means for you to enter information and obtain results. The computer stores and retrieves assay profiles, executes the defined worklist, and performs the various calculations needed for the assay.

The computer system that is used for operation of the *DSX™ Automated ELISA System* must meet the following minimum requirements:

- Pentium microprocessor running at 500 MHz or better.
- Hard disk with at least 100 MB of free space.
- Microsoft® Windows® NT operating system.
- VGA graphics card (Super VGA recommended). Monochrome, CGA, EGA or calibrated monitors are not supported.
- The Display properties should be set to a desktop area of at least 600 x 800 pixels and a color palette of at least 256 colors.
- At least 64 megabytes (MB) of random-access memory (RAM). (128 MB RAM is recommended).
- One unused RS232 serial port is required for connecting the computer to the *DSX™ Automated ELISA System*.
- Mouse or other pointing device supported by Windows.
- Any printer that is supported by Windows® NT can be used.
- Compatible sound card

Specifications

Dimensions and Weight

Depth	<91 cm (35.8 in)
Width	<106 cm (41.8)
Height	<80 cm (31.5 in)
Weight	<110 Kg (243 lbs)
Footprint	106 cm x 91 cm (41.8 in x 35.8 in)

Capacities

Samples	96
Reagents	24
Controls and/or Standards	33
Sample Pipetting Tips	432
Reagent Pipetting Tips	41
Wash Buffer Bottles	4 bottles, 2 liters each
Waste Container	8 liters

Operation

Ambient Drawer Module Incubation Temperatures	Ambient plus 5 °C
Incubator Module Incubation Temperatures	Ambient plus 7 °C to 50 °C

Assays

Blanking	Air Individual, paired or average wells Whole plate or last plate Row or column Each well on the plate
Wavelength Modes	Single, dual or multiple
Standard Curves	Linear, quadratic, cubic, quartic, spline, polygon, sigmoid or Akima
Additional Data Analysis	Threshold, ratio, QC equations
Flexible Template	Up to eight different well types.

Power Requirements

	Voltage	Power	Frequency
Main Unit	100 - 240 V	800 VA	50/60 Hz
Line Voltage Variation	± 10%		
Line Frequency Variation	± 3 Hz		

Environmental

Operating Range	15° C to 30° C 15% to 85% relative humidity (non-condensing) 2000 Meters Altitude

Computer Interface

Ports	RS232 serial port
Baud Rate	19200. Character format.
Character Format	7 data bits, 1 stop bit, no parity

Standards

The instrument is designed in accordance with CSA 1010-1, CSA 1010-2-010, UL 3101-1, EN 61010-1, EN 61010-2-010 and EN 61326-1.

Warning Labels

The *DSX™ Automated ELISA System* or its components may contain certain labels that that either warn the user of a hazard or note an electrical connection. A hazard is something that can cause personal injury to the operator or damage to the instrument. The labels that may be used on the *DSX™ Automated ELISA System* are described below.

Label	Description
	Alternating current is present.
	(*English*) Caution symbol. Refer to the *Routine Maintenance* chapter. (*French*) Attention (voir documents d'accompagnement).
	(*English*) Caution, motion hazard. (*French*) Attention
	(*English*) Caution, pinching or mechanical hazard. (*French*) Attention
	(*English*) Caution, hot surface. (*French*) Attention, surface chaude.
	Protective conductor terminal.
	Earth (ground) terminal.
	(*English*) Caution, risk of electric shock. (*French*) Attention, risque de choc électrique.
	Caution, biohazard.

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Chapter 3 Installation

***IMPORTANT**: These installation procedures are intended for trained personnel.*

Unpacking

Materials Provided

Article	Quantity
DSX™ Automated ELISA System	1
Instrument Power Cable	1
RS232 Communication Cable	1
Cleaning Wire	1
CD Containing Revelation™ Software Setup Program and Electronic Operator's Manual	1
Shipping Check List	1
Wash Buffer Containers	4
Liquid Waste Container	1
Reagent Rack	1
Tip Waste Container	1
Computer and Monitor (optional)	1
Consumables Sample Kit	1
Plastic Tweezers	1
Needle Nosed Pliers	1
3 mm Allen Wrench	1
4 mm Allen Wrench	1

To unpack the components:

1. Unpack the contents of the carton.

☞ ***CAUTION****: The contents are heavy (approximately 110 Kg or 240 lbs) .*

2. Place the DSX™ *Automated ELISA* instrument in the approximate position where it will be located.

3. Examine the packaging to be sure that the power cord, the computer connector cord and other materials have been removed. Please save packaging material for future use.

4. Check to verify that all of the materials listed on the previous page have been unpacked.

5. Inspect the components for damage. If damage is observed, contact your shipper or service representative immediately.

Positioning the Instrument

Determine the area where the system will be located. You will need an area that is approximately 106 cm (41.8 inches) wide, 91 cm (35.8 inches) deep, and 80 cm (31.5 inches) high for the *DSX™ Automated ELISA System*.

The system should be positioned on a level surface that does not support other devices that produce vibration (centrifuges, shaker bath, etc.). There must be at least 20 cm (7.9 inches) of space at the rear of the instrument to allow for sufficient ventilation.

Connecting the Computer System

***Note**: A computer system is required but not provided.*

To connect the computer system:

1. Place the computer, keyboard, monitor and printer next to the DSX System.

2. Plug the RS232 communication cable into an unused RS232 port on the computer. Note the computer port (i.e., COM1 or COM2) that is used.

   ***Note**: Refer to the instructions accompanying the computer for the location of the ports and for information on connecting components.*

3. Plug the other end of the RS232 communication cable into the bottom RS232 port at the right side of the instrument (Figure 19).

   ***Note:** The lowest of the 3 RS232 ports must be used. The other RS232 ports are used for diagnostic purposes. See Figure 19.*

4. Connect the keyboard, monitor and printer to the computer.

5. Connect the power to the computer, monitor and printer.

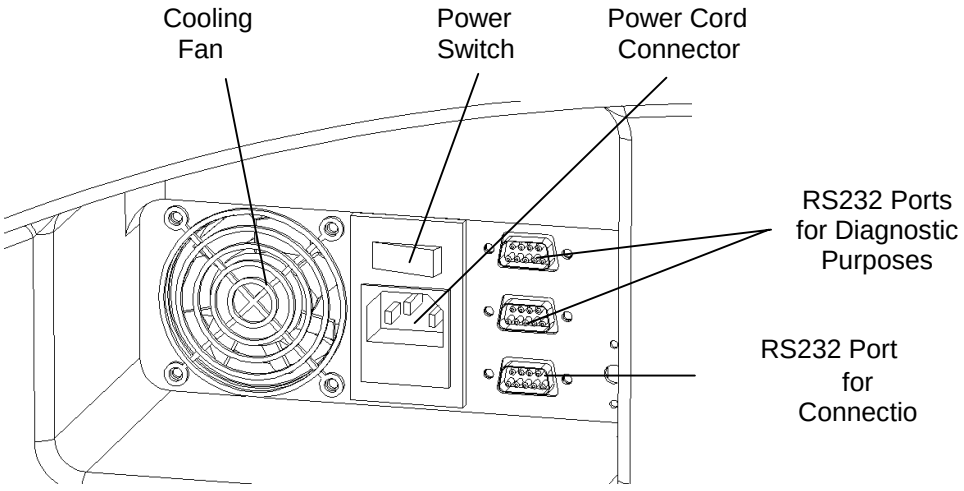


Figure 19. View of the Right Side of the *DSX™ Automated ELISA System*

Connecting to a LIMS

The RS232C port is bi-directional when used in computer control mode. The DSR/DTR handshake signals as well as software handshake are used to maintain communication status and synchronization.

To Establish Computer Control Mode for the Reader

	Computer	Reader
1.	DSR asserted	
2.	STX COMMAND ARGUMENTS checksum ETX. Sends command character string.	
3.		ACK/NAK Indicates proper/improper reception
4.		Executes task
5.		ENQ Asks if computer is ready to receive answer
6.	ACK/NAK Indicates ready/not ready to receive	
7.		STX RESULTS/ANSWER checksum EXT Sends answer
8.	ACK/NAK Indicates proper/improper reception	

☞ ***Note:*** *Steps 2 to 8 are repeated for subsequent transmissions provided the data link remains connected. Results may require more than a single transmission, in which case Step 5 through Step 8 must be repeated. If the computer does not acknowledge receipt of data (NAK) in either Step 6 or in Step 8, the DSX will return to Step 5 and re-transmit the results.*

Checksum

The DSX Reader is equipped with a Fletcher's checksum algorithm to protect against any communication problems.

The checksum is calculated as follows:

sum 1 = 0
sum 2 = 0
for i from 1 to message length do
sum 1 = (sum 1 + message {i}) modulo 255
sum 2 = (sum 2 + sum 1) modulo 255
end for
*checksum = sum 2*255 + sum 1*

This checksum is transmitted as a 4 digit hexadecimal (base 16) number in ASCII format.

Example:

Normal command STX 5 0 ETX

character	ASCII code	sum 1	sum 2
STX	2	0	0
'5'	53	55	57
'0'	48	103	160

Checksum = 160 x 255 + 103 = 40903
= $9FC7_{16}$

The command therefore becomes: STX 5 0 9 F C 7 ETX

Loading Revelation™ Software

Revelation™ software is provided on a CD ROM. Before installing the software on the personal computer, you will need the following information:

- The installation drive. Usually, this will be **d**.
- The installation directory.

To install Revelation Software:

1. Start Microsoft Windows NT.
2. Insert the installation CD ROM.
3. Select Start and then Run from the task bar.
4. Type **d:\setup** in the Run text box.
5. Click **OK**. The setup program will start and the Revelation™ Installation Window will be displayed.

   ☞ ***Note:*** *To stop the installation, click on* ***Exit****.*

6. The prompt **Setup is complete** is displayed when the installation has been completed. Click on **OK** and remove the installation CD ROM.
7. The Revelation™ program group is accessed from the **Programs** section of the **Start** task bar.

   ☞ ***Note:*** *The Revelation™ program icon can be added to your Windows NT desktop using the* ***Settings*** *section of the* ***Start*** *task bar.*

   ☞ *Or, a Revelation™ shortcut icon can be placed on your computer desktop for convenient access to Revelation™. See the following section for instructions.*

Creating a Shortcut Icon

A Revelation™ shortcut icon can be placed on your computer desktop in two ways:

- (Recommended) A shortcut program is created during installation. This program can be dragged to the desktop from Windows Explorer.
- A new shortcut can be created.

to use the installed shortcut:

1. Open Microsoft Windows Explorer.
2. Locate the Revelation™ shortcut in the directory **c:\Windows\Start Menu\Programs\Revelation**.
3. Drag the Revelation™ shortcut icon to the desktop.

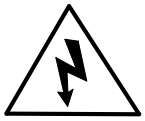
   ☞ ***Note:*** *Be sure to drag the Revelation™ shortcut, not the Revelation™ Help shortcut.*

4. Close Microsoft Windows Explorer.

Connecting the DSX Power Cord

The power cord connection to the DSX is made at the right side of the system.

***Note**: Depending upon local electrical codes and electrical service quality, an optional uninterruptible power supply (UPS) may be required in your laboratory. The use of a UPS is optional but recommended.*



***CAUTION:** The* DSX *System must be connected to properly grounded electrical outlets. Obtain assistance from a qualified electrician to verify that your electrical outlets are properly grounded.*

Before connecting the power cable, be sure that the components have been connected to each other as outlined in the previous section.

To connect the power cord:

1. Connect the power cord to the connector at the right side of the instrument (Figure 19).

2. Connect the other end of the power cord to the laboratory electrical supply outlet.

Starting the System

To start the system:

***CAUTION**: Before starting the system, be sure that all racks are properly seated and that the lids are removed from all tubes, plates and sample tip racks.*

1. Turn the DSX System power switch (Figure 19) ON.
2. Turn the power ON (if necessary) for the computer, monitor and printer.
3. Double-click the Revelation™ shortcut icon. Or, select **Revelation** from the **Program** menu in Windows NT.
4. A startup dialog box is displayed listing startup choices (Figure 20).
5. Select **Connect to DSX** to operate the DSX System.

   Or, select **Configure Hardware** to display the Setup DSX dialog box for configuring the system (see page 48).

***Note**: Select **Connect in Demo Mode** to run the sofware in demonstration mode. The DSX System is not connected during demonstration mode. Select **Quit Revelation** to exit from the Startup dialog box.*

Figure 20. Startup Dialog Box

Self Tests

A series of self-tests are carried out after **Connect to DSX** is selected from the Startup dialog box. The test results are displayed upon completion of the tests (Figure 21).

The self-test results should be printed on a monthly basis so that a record can be kept of the performance of the DSX System. You can save test results (the test results files are named ***.tst**) and then open them for review or printout at a later date.

NOTE: *The self-test results should indicate whether the system is operating properly. If a self-test failure is reported in the Self-Test window, it is recommended that you call Technical Service.*

To print self-test results:

1. Select **Print** from the **File** menu while the self test results are displayed.

NOTE: *If the DSX data files have been corrupted, the DSX prompts for the serial number. This can be found on the DSX rear panel.*

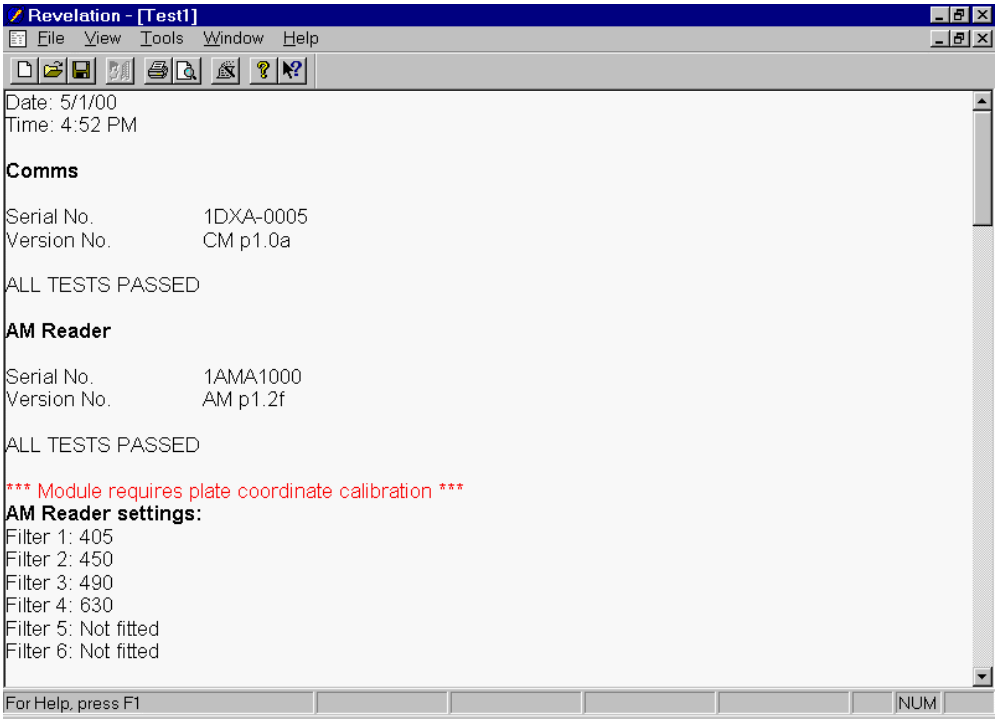


Figure 21. Display of Self-Test Results

Chapter 4 Preparing the System for Use

Configuring the Reader

Configuring the reader allows the user to define the COM port, specify the filters that are installed and specify conversion limits, specify maintenance scripts, and specify a log file.

To configure the reader:

1. Select **Configure Reader** from the **Tools** menu. The Reader Type dialog box is displayed (Figure 22).

2. Select **Setup**. The Setup DSX dialog box is displayed (Figure 23).

   ☞ ***NOTE:*** *The Setup DSX dialog box can also be displayed by selecting* ***Configure Hardware*** *from the Startup dialog box (Figure 20).*

3. Specify the settings for each of the Reader configuration options.

   ☞ ***NOTE:*** *Detailed instructions for an operation are contained in the* DSX *Online Operator's Manual, accessed by selecting the* ***Help*** *button on the dialog box that is being used.*

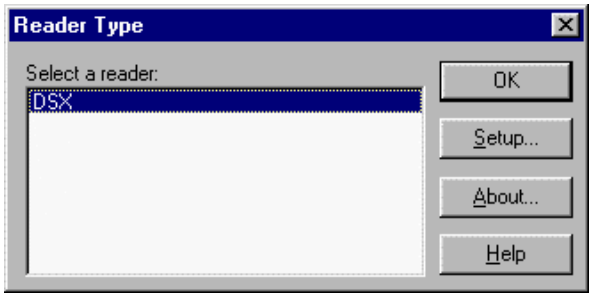


Figure 22. Reader Type Dialog Box

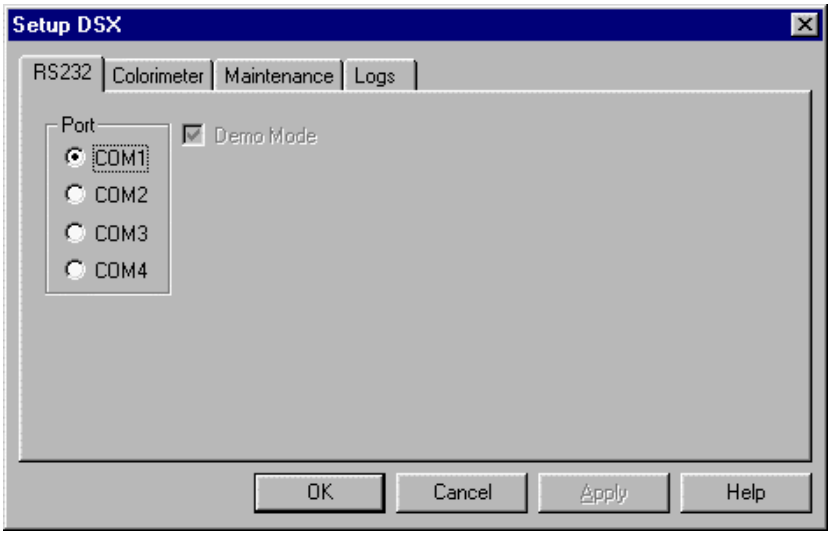


Figure 23. Setup DSX Dialog Box

Editing Washer Plate Settings

The wash head on the DSX must be aligned so that the tips of the wash pins are aligned with the base of the washer when the wash module is in Standby.

To edit the washer plate settings:

1. Obtain a microplate of the type for which the washer is to be aligned.

2. Eject the washer plate carrier and carefully place the microplate in the carrier.

3. Retract the plate carrier.

4. Select **Edit Washer Plates…** from the **Tools** menu. The Edit Washer Plate Settings dialog box is displayed (Figure 24).

5. Click **New** and enter a name for the type of plate for which the wash settings are being entered.

   Or: If settings for a plate that is already defined are being edited, select the plate from the Plates Currently Defined panel.

6. Click the Show button opposite the Dispense Height field to position the wash head in the dispense height position.

   ☞ ***Note****: Refer to page 16 for a description of the various wash height positions.*

7. If the dispense height needs to be changed, enter the new value in the Dispense Height field.

8. Click the Show button opposite the Dispense Height field to position the wash head in the new dispense height position.

9. Repeat Steps **7** and **8** until the dispense height is correct.

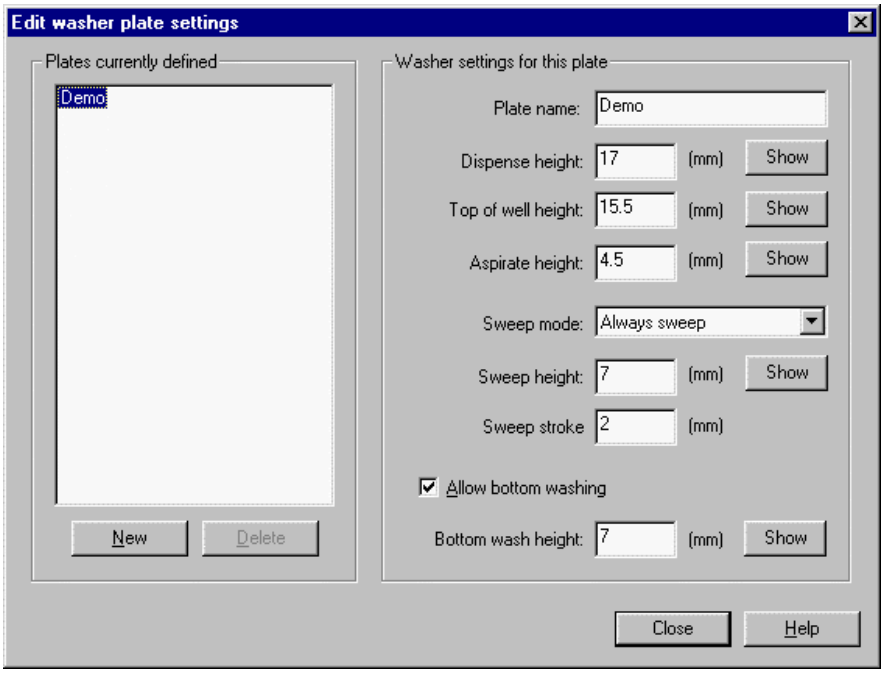


Figure 24. Edit Washer Plate Settings Dialog Box

10. Repeat Steps **6** through **9** for each of the other wash height positions.

11. Select the sweep mode and the sweep stroke.

☞ ***Important**: Select **No Sweep** for sweep mode and disable bottom washing whenever a C-bottom, U-bottom or V-bottom plate is being used.*

12. If sweep mode is enabled, specify the sweep stroke.

13. Click on **Close** to save the entered values.

☞ ***NOTE:** Detailed instructions are contained in the* DSX *Online Operator's Manual, accessed by selecting the **Help** button on the dialog box that is being used.*

Selecting the Results Font

The user can select the font that is used when results reports are printed.

To select the results font:

1. Select **Results Font** from the **Tools** menu. The Font dialog box is displayed (Figure 25).

2. Select the results font.

NOTE: *Detailed instructions are contained in the* DSX *Online Operator's Manual, accessed by selecting the* ***Help*** *button on the dialog box that is being used.*

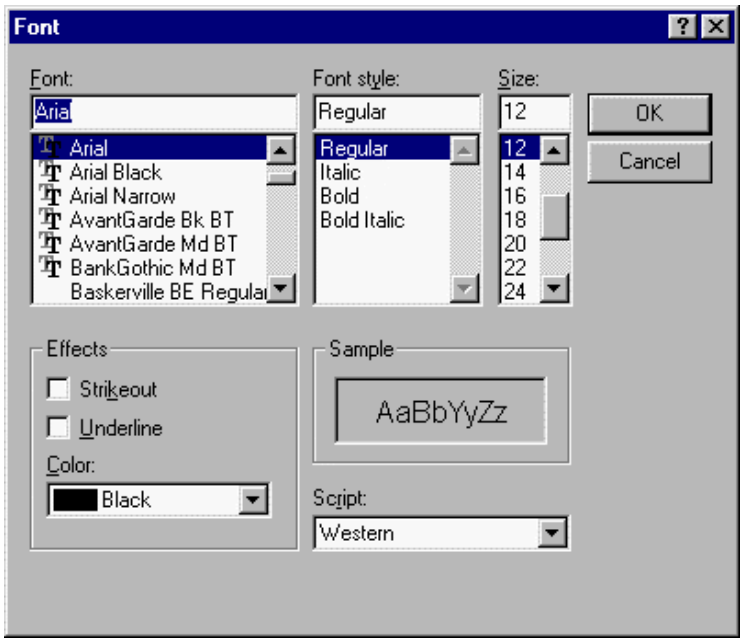


Figure 25. Font Dialog Box

Setting Options

Options allow the user to create assay short-cut buttons, set default plate processing options (including auto save and auto print), select colors for different well types, set default directories and enter the laboratory name, address and phone number(s) to be printed on results reports.

To set options:

1. Select **Options** from the **Tools** menu. The Options dialog box is displayed (Figure 26).

2. Specify the settings for each of the Options tabs.

NOTE: *Detailed instructions are contained in the* DSX *Online Operator's Manual, accessed by selecting the* ***Help*** *button on the dialog box that is being used.*

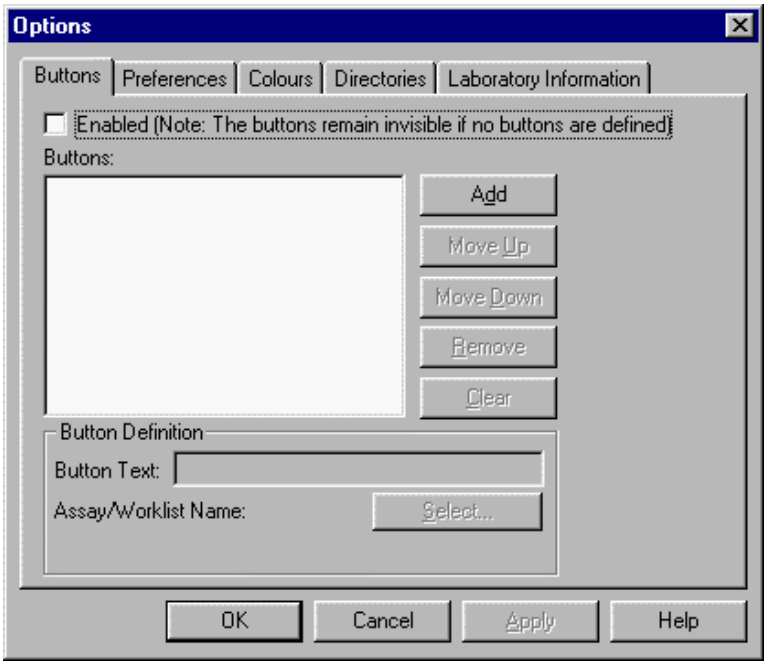


Figure 26. Options Dialog Box

Changing the Password

The system password can be changed.

To change the system password:

1. Select **System Password** from the **Tools** menu. The System Password dialog box is displayed (Figure 27).

2. Specify a new system password.

NOTE: *Detailed instructions are contained in the* DSX *Online Operator's Manual, accessed by selecting the* ***Help*** *button on the dialog box.*

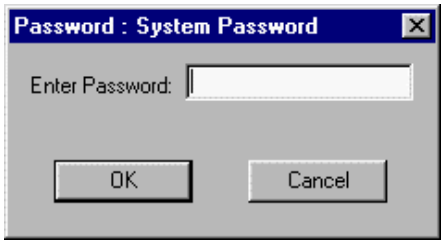


Figure 27. System Password Dialog Box

Specifying Consumables

A database of all consumables and fluids is maintained in the software. Once a consumable or fluid is defined in the database, it is available for selection from a drop-down list during definition of an assay.

To enter information for a consumable:

1. Select the appropriate command (i.e., **Edit Washer Fluids…**) from the **Tools** menu. The corresponding dialog box is displayed.

   ☞ ***NOTE:*** *Detailed instructions are contained in the* DSX *Online Operator's Manual, accessed by selecting the* ***Help*** *button on the dialog box.*

2. Reagent bottles, Sample tips and Reagent tips are all pre-defined in the Revelation™ software. Refer to Reagents and Pipetting in Chapter 1 Overview for the ordering information.

Filling the Wash Buffer Containers

The Wash Buffer Containers must be filled with the appropriate wash buffer and the dispense tubing and dispense pump power cable must be connected to the front of the instrument.

To fill the Wash Buffer Containers:

1. Disconnect a Wash Buffer Container (see page 18) and remove it from the system.

2. Remove the rear cover of the Wash Buffer Container (Figure 12) and fill it with the wash solution that is to be used.

   ☞ ***Note**: The Wash Buffer Containers each contain up to two liters.*

3. Make sure that the dispense tubing is routed through the appropriate pinch valve at the front of the instrument.

4. Connect the dispense tubing to the Wash Buffer Container and connect the Wash Buffer cable to the connector at the front of the instrument (refer to Figure 12 for details).

   ☞ ***Note**: Be sure that the wash tubing is not pinched or crimped.*

5. Repeat Steps 1 through 4 for the remaining wash buffer containers.

Connecting the Waste Container

The Waste Container must be connected to the front of the instrument.

To connect the Waste Container:

1. Route the waste tubing through the routing holes inside the front panel of the instrument.

2. Connect the vacuum tubing and the waste tubing to the connectors at the front of the instrument.

   ☞ ***Note**: The connectors for the vacuum tubing and the waste tubing are a different size so they cannot be reversed.*

   ☞ ***Note**: Be sure that the waste tubing and the vacuum tubing are not pinched or crimped.*

3. Connect the level sensor cable to the connector at the front of the instrument.

Chapter 5 Defining an Assay

Creating a New Assay

The assay(s) for a worklist must be created before a worklist can be prepared. **Assay operations** (pipetting, dispensing, washing and incubating) and **data reduction** steps (see page 29) are specified in the assay.

To create a new assay:

1. Select **New** then **Assay** from the **File** menu. A default assay is displayed.

2. Define the **assay operations** and **data reduction** steps as outlined below.

To define assay operations:

1. Display the default assay (see above).

2. Select the desired assay operation from the **Operations** menu. The appropriate dialog box is displayed.

3. Define the operation.

NOTE: *Detailed instructions are contained in the* DSX *Online Operator's Manual, accessed by selecting the* ***Help*** *button on the dialog box that is being used.*

To define data reduction steps:

1. Display the default assay (see above).

2. Select the desired data reduction step from the **Data Reduction** menu. The appropriate dialog box is displayed.

3. Define the data reduction step.

NOTE: *Detailed instructions are contained in the* DSX *Online Operator's Manual, accessed by selecting the* ***Help*** *button on the dialog box that is being used.*

Modifying an Assay

An assay can be modified at any time.

To modify an assay:

1. Select **Open** from the **File** menu. The Open dialog box is displayed (Figure 28).

2. Select the assay to be modified.

3. Modify the assay operations and/or data reduction steps as outlined on the previous page.

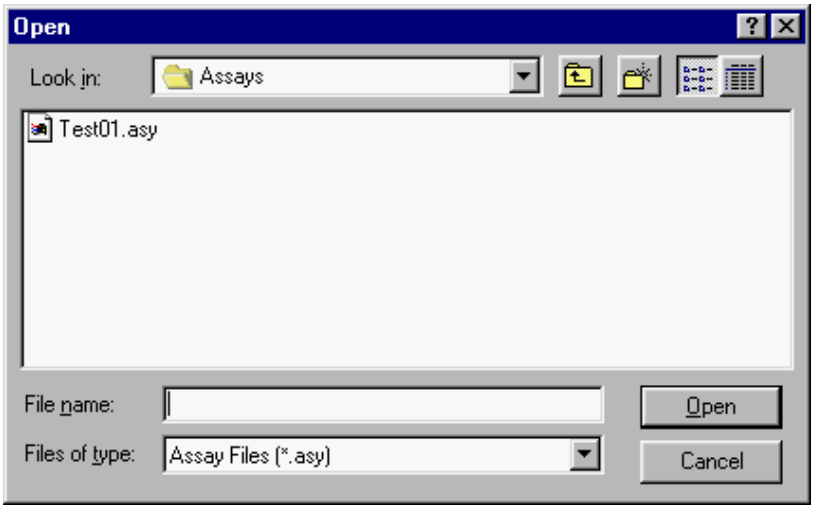


Figure 28. Open Dialog Box

Chapter 6 Creating a Worklist

Creating a New Worklist

A **worklist** specifies the assay(s) to be run on a series of samples. Once at least one assay exists, a worklist can be created.

NOTE: *The worklist can include up to four microplates.*

Only one worklist can be open at a time.

More than one assay can be run on one plate if the assays have the same incubation, washing and shaking specifications.

To create a new worklist:

1. Select **New** then **Worklist** from the **File** menu. The Edit Worklist dialog box (Figure 29) is displayed.

2. Define the worklist. Detailed instructions are contained in the *DSX Online Operator's Manual*, accessed by selecting **Online Manual** from the **Help** menu.

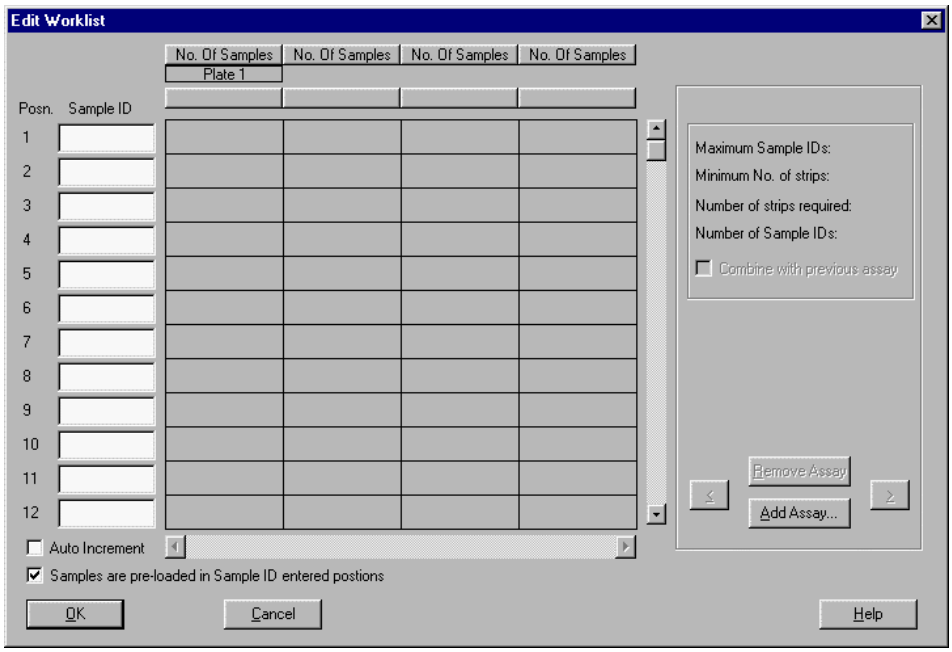


Figure 29. Edit Worklist Dialog Box

Modifying a Worklist

An worklist can be modified at any time. However, only one worklist can be open at a time.

To modify a worklist:

1. Select **Edit** from the **File** menu. The Open dialog box is displayed (Figure 28).

2. Select **worklist (*wor.)** as the file type.

3. Select the worklist to be modified.

4. Modify the worklist as outlined on the previous page.

Chapter 7 Running a Worklist

Preparation

Prepare for a run by setting the runtime options, emptying the waste container and filling wash buffer bottles with wash buffer (if required).

To set runtime options:

1. Display the worklist to be run (if needed)

2. Select **Runtime Options** from the **Timeline** menu. The Runtime Options dialog box (Figure 30) is displayed.

3. Define the runtime options. Detailed instructions are contained in the *DSX Online Operator's Manual*, accessed by selecting **Online Manual** from the **Help** menu.

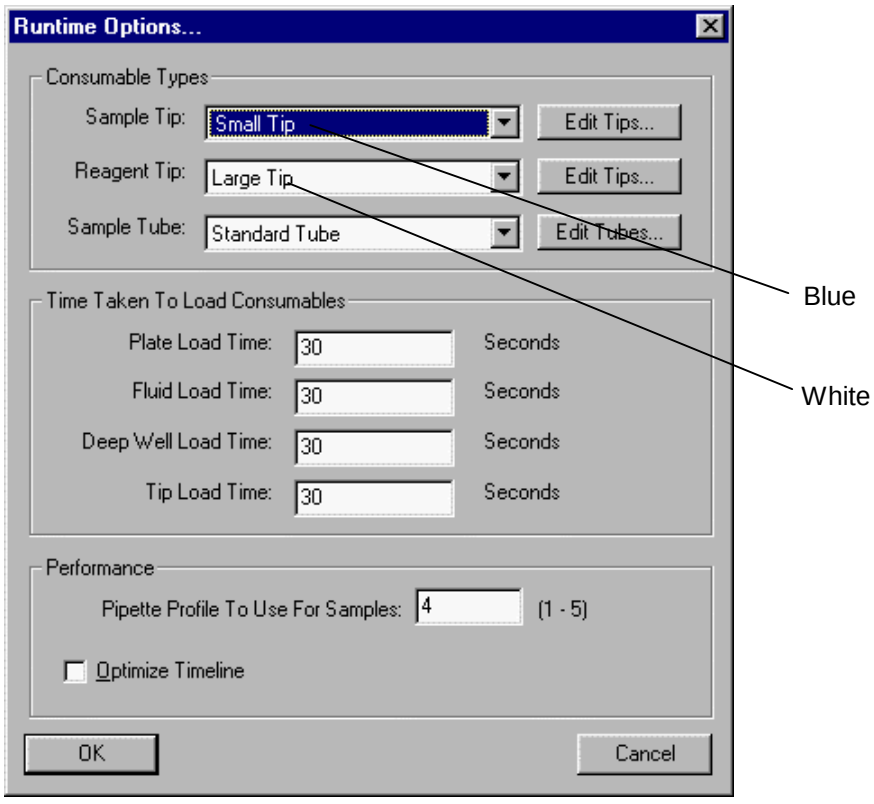


Figure 30. Runtime Options Dialog Box

To empty the Waste Container:

1. Disconnect the Waste Container (see page 20) and remove it from the system.

2. Remove the cover of the Waste Container and discard the waste in accordance with local regulations.

3. Rinse the waste container with DEIONIZED water. Discard the rinse water.

   ☞ ***Note**: If desired, the waste container can be disinfected with a 10% (v/v) solution of household bleach in water, or 70% ethanol. If bleach is used, the container must be thoroughly rinsed with deionized water before replacing, as residual bleach may affect the results of ELISA assays.*

4. Replace and tighten the waste cap.

   ☞ ***Note**: Be sure that the waste cap is securely tightened. Otherwise, a vacuum leak will cause the software to create a vacuum error condition.*

5. Place the Waste Container on the system and re-connect the fittings.

To fill a wash buffer bottle:

1. Disconnect the Wash Buffer Container (see page 18) and remove it from the system.

2. Remove the rear cover of the Wash Buffer Container (Figure 12). Lay the cover on a clean paper towel.

3. Fill the wash buffer bottle with the wash buffer that is to be used.

   ☞ ***Note**: If the wash buffer in a bottle is being changed, discard the contents of the bottle and thoroughly clean it before filling it with the new wash buffer.*

4. Replace the cover and tighten it.

5. Place the Wash Buffer Container on the system and re-connect the fittings.

Starting the Run

To start the run:

1. Display the worklist to be run (if needed)
2. Select **Start** from the **Timeline** menu. A prompt to load the first microplate is displayed (Figure 30).
3. Place the first microplate on the plate drawer in the position shown.
4. Enter the plate ID (or read the plate barcode).
5. Click **OK**. The next prompt is displayed.
6. Follow additional instructions, making sure to load each item at the designated position. After an item is loaded and information (if any) is entered, click **OK** to display the next prompt.

   ***Important**: All racks are mounted on dowel pins. Be sure that each rack is securely seated and cannot move in either the **x-** or **y-** direction.*

7. Detailed instructions are contained in the *DSX Online Operator's Manual*, accessed by selecting **Online Manual** from the **Help** menu.

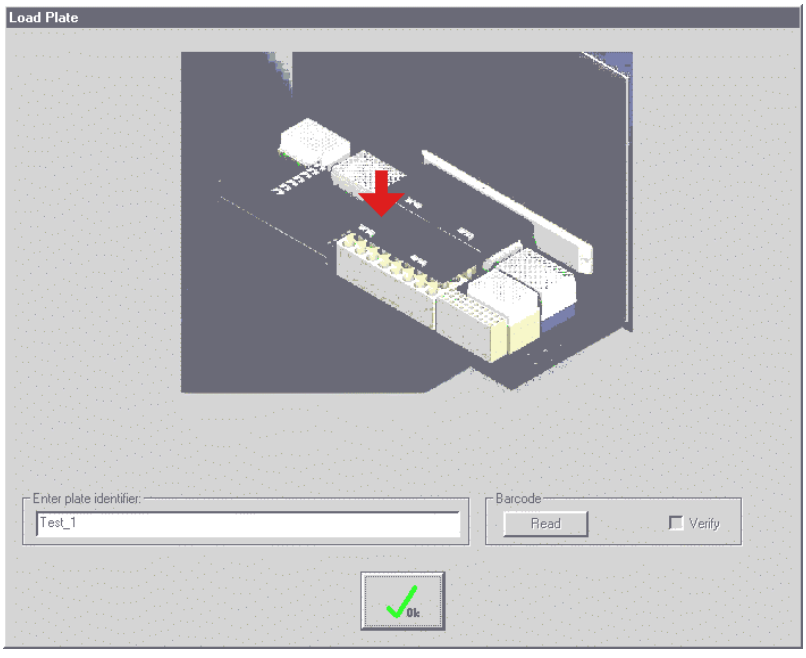


Figure 31. Load Plate prompt

Monitoring Run Status

To monitor status of the run:

1. Display the worklist (if needed).

2. Select **Worklist**, **Timeline**, **Consumables** or **Plate Layout** from the **Timeline** menu. The corresponding view of the run is displayed (Figure 32).

3. Detailed instructions are contained in the *DSX Online Operator's Manual*, accessed by selecting **Online Manual** from the **Help** menu.

Figure 32. Timeline View

Chapter 8 Service and Maintenance

Routine Maintenance Procedures

The following periodic maintenance procedures are required for the *DSX™ Automated ELISA System*:

Daily maintenance:

- Verify that the self-test passes.

  ☞ ***Note**: Results of the self-test can be printed if desired. Refer to page 46 for specifying printing of self-test results.*

- Empty and clean the Waste Tip Container.

☞ ***Warning**: While the DSX alone does not present a biohazard, the samples that are used and all parts and consumables in contact with the samples must be considered biohazardous.*

- (As needed) Empty and clean the Liquid Waste Container.

  ☞ ***Note**: If desired, the Waste Tip Container and the Liquid Waste Container can be disinfected with a 10% (v/v) solution of household bleach in water, or 70% ethanol. If bleach is used, the containers must be thoroughly rinsed with deionized water before replacing, as residual bleach fumes may affect the results of ELISA assays.*

- Clean all plate drawers and external surfaces, using a towel moistened with 70% alcohol.
- Purge the washer with 50mL of deionized water.

  ☞ ***Note**: The deionized water used for purging should be placed in Wash Buffer Container D (see Figure 11).*

Weekly maintenance:

- Empty the Wash Buffer Containers and clean them with several rinses of deionized water.
- Remove and clean the waste tip chute.

***Note**: If desired, the waste tip chute can be disinfected with 70% alcohol or by autoclaving it. Bleach should not be used since it will corrode the metal.*

Six month maintenance:

- Replace the dispense tubing.
- Replace the aspiration tubing.

***Note**: The dispense tubing and aspiration tubing may need to be replaced more frequently than every six months, depending upon the frequency of use and the severity of operating conditions.*

Contact DYNEX for information on replacement tubing.

Cleaning and Decontamination

The *DSX™ Automated ELISA System* is constructed from materials that resist chemical attack.

Spills should be cleaned as soon as possible. If you need to decontaminate the *DSX™ Automated ELISA System* instrument (for example, before servicing the instrument), clean the system and then decontaminate it as described below.

***CAUTION**: Always disconnect the power cable before cleaning the instrument.*

To clean the system:

1. Clean external surfaces with a cloth moistened with mild laboratory detergent.

***Note**: If needed, dilute the laboratory detergent according to the manufacturer's instructions before using.*

To decontaminate the system:

1. Wipe the surfaces with a cloth moistened with a 10% (v/v) solution of household bleach in water or a 70% (v/v) solution of alcohol.

***Note**: Remove residual bleach from surfaces with a cloth moistened with deionized water. Residual bleach may affect the results of ELISA assays.*

Removing a Module

The incubator modules, absorbance module and the wash module can be easily removed from the *DSX™ Automated ELISA System*.

To remove an incubator module or the absorbance module:

1. Loosen the fasteners (Figure 33) one-fourth (¼) of a turn using a 4 mm Allen wrench.

   ☞ ***Note**: The incubator modules and the absorbance module each have two fasteners.*

2. Pull the module out of the housing.
3. Replace the module by reversing the procedure.

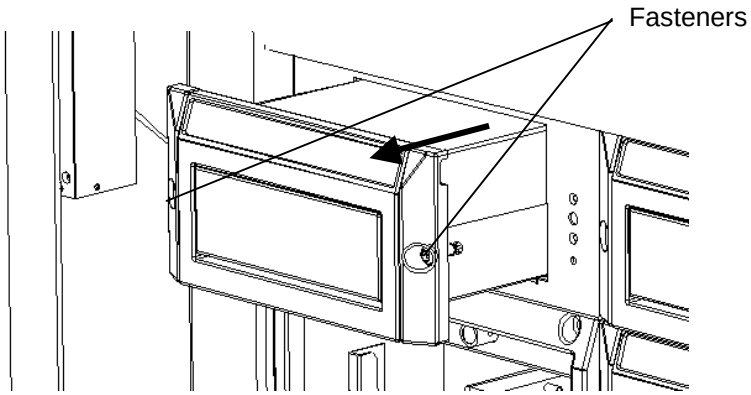


Figure 33. Fasteners on the Incubator Modules or Detection Module

To remove the wash module:

1. Remove the wash head by loosening the thumb screw.
2. Disconnect the tubing from the dispense valve on the washer module.
3. Loosen the fasteners one-fourth (¼) of a turn using a 4 mm Allen wrench.

   ☞ ***Note**: The wash module has four fasteners.*

4. Pull the module out of the housing.
4. Replace the module by reversing the procedure.

Replacing the Absorbance Module Lamp

***CAUTION**: The optics assembly may be hot. Allow at least five minutes for the instrument to cool before opening the optics assembly.*

Also, be careful when removing the filter access panel as there is a possibility that the bulb may have broken.

Failure to follow the lamp replacement procedures as described may result in personal injury.

***CAUTION**: Always disconnect the power before removing the filter access panel.*

To replace a lamp:

1. Remove the absorbance module from the system.
2. Remove the filter access panel to expose the optical assembly. The bulb is mounted in the upper portion of the optical assembly as shown in Figure 34.

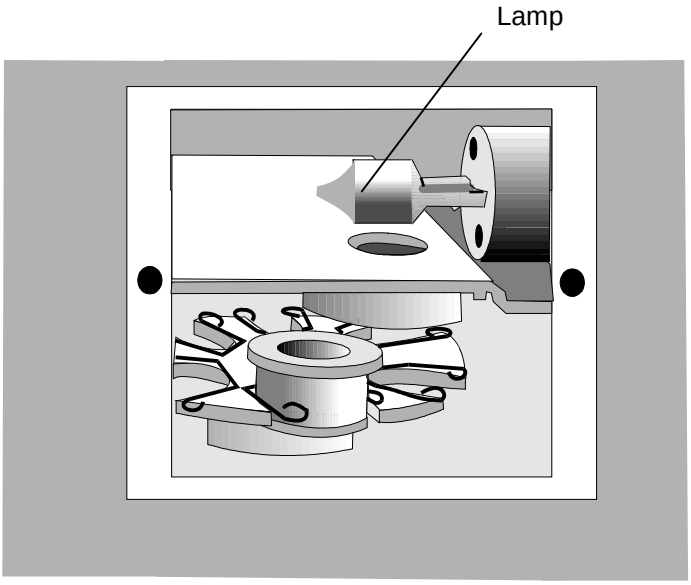


Figure 34. Optical Assembly

3. Put on a pair of rubber or latex gloves.

   ☞ ***CAUTION**: Gloves are necessary to prevent skin oils from damaging the lamp. Gloves are also worn as a safety precaution should the glass bulb accidentally break.*

4. Grasp the lamp with plastic tweezers and pull the lamp out of its receptacle (Figure 35).

   ☞ ***IMPORTANT**: Use a gloved finger to prevent the bulb from bumping into the metal sidewalls of the enclosure during removal.*

5. Obtain a replacement lamp.

6. Grasp the lamp tines with plastic tweezers and align the tines with the corresponding holes in the lamp socket.

7. Firmly insert the lamp into the socket.

8. Replace the filter access panel.

9. Replace the absorbance module.

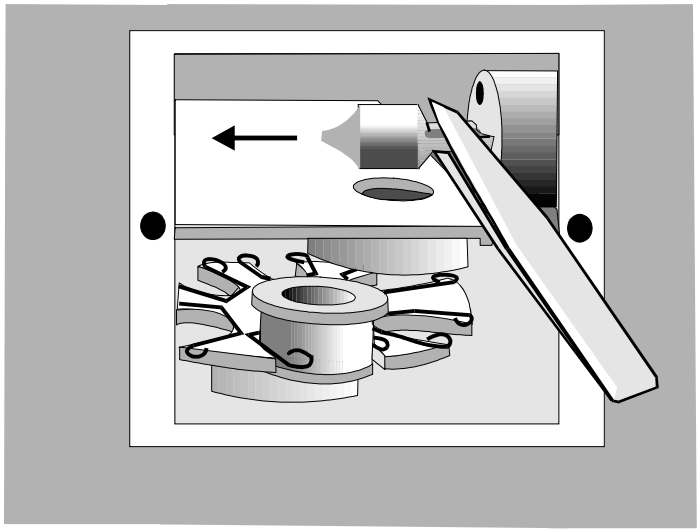


Figure 35. Removing the Lamp

Replacing an Absorbance Module Filter

***CAUTION**: The optics assembly may be hot. Allow at least five minutes for the instrument to cool before opening the optics assembly.*

Also, be careful when removing the filter access panel as there is a possibility that the bulb may have broken.

***CAUTION**: Always disconnect the power before removing the filter access panel.*

To remove a filter:

1. Remove the absorbance module from the system.
2. Remove the filter access panel. The filters are mounted on the filter wheel as shown in Figure 34.
3. Locate the filter that is to be removed.
4. Firmly grasp the exterior filter housing with a pair of needle nose pliers (Figure 36).
5. Pull the filter out of the spring loaded slot.
6. Replace the filter access panel.

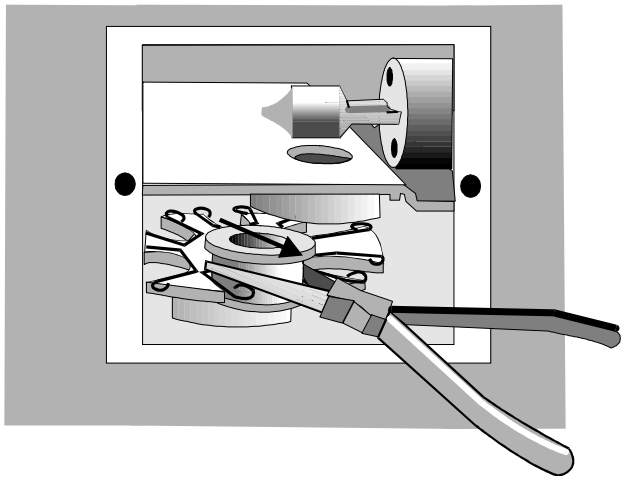


Figure 36. Removing a Filter

To install a filter:

1. Remove the filter access panel. The filters are mounted on the filter wheel as shown in Figure 34.

2. Locate the filter position in which the filter will be installed.

   ☞ ***IMPORTANT**: Filters must be installed in adjacent filter positions, in the order of their wavelength. There must not be any empty filter positions between the lowest wavelength and highest wavelength filters.*

   ☞ ***Note**: If a new filter is installed in a previously empty position or if the wavelength is being changed, the wavelength of the new filter must be entered. See page 47 for details.*

3. Firmly grasp the exterior filter housing with a pair of needle nose pliers.

4. Push the filter into the spring loaded slot.

5. Replace the filter access panel.

   ☞ ***IMPORTANT**: The bottom groove of the filter must be firmly seated in the filter wheel. If the groove is aligned with the spring on the filter wheel then the filter has been installed incorrectly and will result in invalid instrument performance.*

6. Replace the absorbance module.

Replacing the Tubing

To replace the tubing:

1. Lift the rear edge of the metal panel at the front of the system (Figure 37) to expose the tubing.

   ☞ ***Note**: The metal panel is hinged at the front. When lifting the front panel, prevent it from dropping all the way forward.*

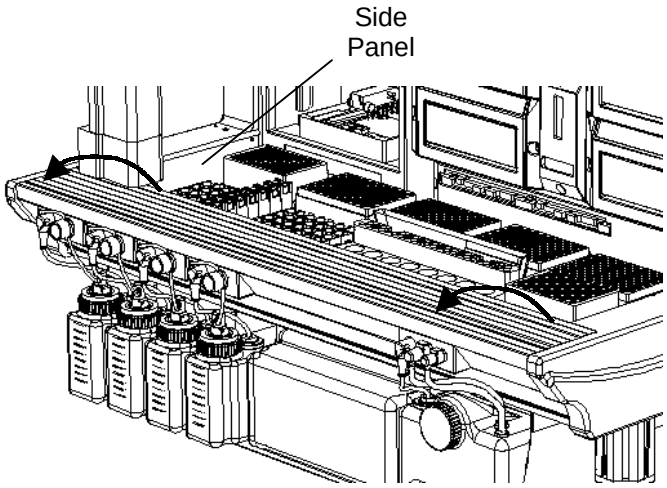


Figure 37. Lifting the Front Panel

2. Remove the four Allen screws from the left side panel, using a 3 mm Allen wrench, and remove the panel.
3. A diagram of the hydraulic tubing for the *DSX™ Automated ELISA System* is shown in Figure 38. Consult the diagram for routing of the tubing.
4. Replace the tubing and fittings as required.
5. Replace the side panel and secure it using the Allen screws.
6. Close the front panel.

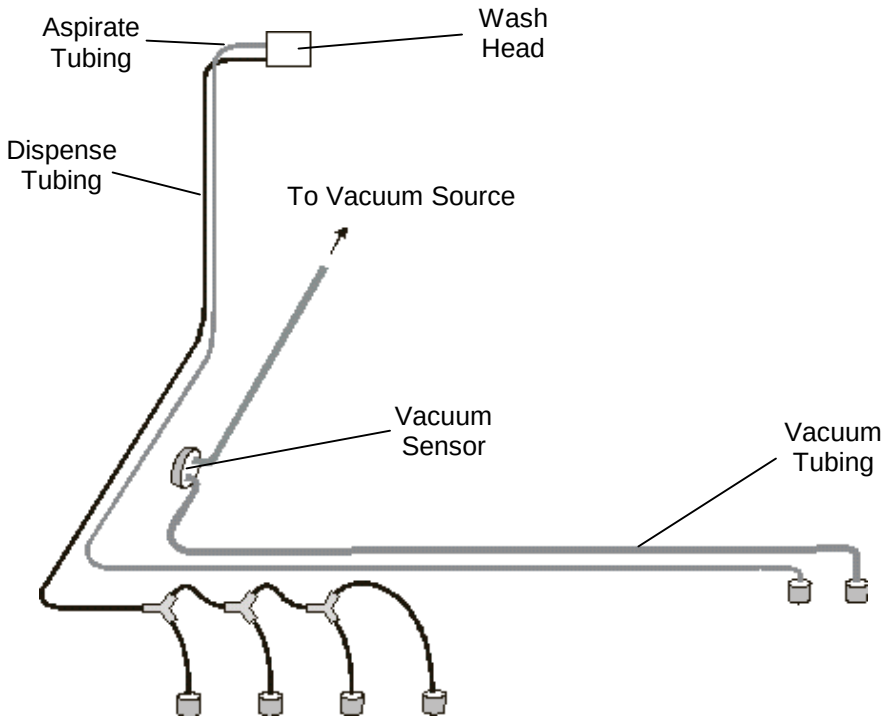


Figure 38. Hydraulic Tubing Diagram

Cleaning the Wash Head

***CAUTION**: Always disconnect the power before servicing the system.*

To remove the wash head assembly:

1. Grasp the wash head assembly and lift it up from the retaining cradle.

2. Lift the wash head and tubing clear of the instrument. If necessary, remove the wash tubing and waste tubing from the retainer clips at the front of the instrument.

To clean the wash head assembly:

1. Pass the Cleaning Wire through the inside of each wash pin and waste pin on the wash head.

2. Run a PURGE to rinse any material from the wash pins.

To replace the wash head assembly:

1. Position the wash head assembly back in the retaining cradle.

2. If necessary, replace the wash tubing and waste tubing into the retainer clips at the front of the instrument.

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Chapter 9 Service

Returning a Module for Service

If the instrument must be returned for service, it must be cleaned and decontaminated if it has been in contact with potentially infectious body fluids (including human blood), pathological samples, or toxic or radioactive materials.

***Warning**: While the DSX alone does not present a biohazard, the samples that are used and all parts and consumables in contact with the samples must be considered biohazardous.*

***Note**: Refer to page 67 for cleaning and decontamination instructions.*

To return a module for service:

***Note**: Refer to page 68 for module removal instructions.*

1. Contact the nearest DYNEX technical service facility for return authorization.
2. Clean and decontaminate the module.
3. Fill out an Equipment in Transit form (Figure 39).
4. Pack the module and the Equipment in Transit form for shipment.
5. After you receive a return authorization, ship the module to the nearest DYNEX facility (see page 78).

DYNEX
TECHNOLOGIES
The Microtiter® Company

EQUIPMENT IN TRANSIT

IMPORTANT: Please include a copy of this form with each instrument.

Return Authorization Number: _____
Contact Technical Coordinator, DYNEX TECHNOLOGIES
phone: (800)336-4543 or (703)631-7800 option#3
fax: (703)631-7816
Equipment: _____
Serial Number: _____

EQUIPMENT DECLARATION

Clearly indicate fault condition or reason for return.

CERTIFICATE OF DECONTAMINATION

I certify that the equipment described above has been disinfected/decontaminated* and is clean, dry and fit for transport.
Signed: _____
Title: _____
Date: _____
(DYNEX Technologies reserves the right to refuse improperly cleaned equipment)

Shipping Address: DYNEX Technologies
Attn.: (Above return number)
14340 Sullyfield Circle
Chantilly, VA 20151-1683

***Suggested decontamination methods:**
Readers- Wash all surfaces with a 10% Hypochlorite solution, Follow that with a mild detergent solution.
Washers- Please follow the "Decontamination Procedure" found in the back of the manual.

Figure 39. Equipment in Transit Form

Limited Warranty

Warranty and Special Provisions

DYNEX TECHNOLOGIES, INC. products are fully guaranteed for one year against defects in parts, materials, and workmanship. Defective parts and materials will be replaced or, at the discretion of DYNEX, repaired at no charge for a period of one year and labor required for such replacement or repair will be provided at no charge for a period of one year, provided that the products are utilized and maintained in accordance with the instructions in the applicable operating and servicing manual, and provided further that the products have not, as determined solely by DYNEX, been subject to misuse or abuse by the Customer or other parties unrelated to DYNEX. DYNEX makes no warranty, expressed or implied, as to the fitness of any product for any particular purposes other than those purposes described in the applicable operating and servicing manual, nor does DYNEX make any other warranty, whether expressed or implied, including merchantability, other than those appearing on the face hereof. Where DYNEX guarantees any product, whether under this Warranty or as a matter of law, and there is a breach of such guarantee, the Customer's only and exclusive remedy shall be the replacement or repair of defective parts and materials, as described above. This shall be the limit of DYNEXs liability. Furthermore, DYNEX shall not be liable for incidental or consequential damages. Failure of the Customer to notify DYNEX of a claimed defect by registered mail within thirty days of the discovery thereof shall constitute a waiver of any claim for breach of warranty.

When a product is required by DYNEX to be installed by a DYNEX engineer or technician, the period of this Warranty shall begin on the date of such installation, provided, however, that any use of the product prior to such installation shall, at the sole election of DYNEX. void this Warranty. When installation by DYNEX personnel is not required, the period of this Warranty shall begin on the date of shipment from DYNEX. The period of this Warranty shall begin as described above whether or not the product has been installed or shipped pursuant to a purchase order, and any trail period shall be deducted from the Warranty period that would otherwise apply under a subsequent placed purchase order for that product.

Limitation of Liability. Notwithstanding anything to the contrary contained herein, the liability of SELLER (whether by reason of breach of warranty, breach of contract, tort, or otherwise), including without limitation under any indemnification provision contained herein, shall be limited to replacement of goods returned to DYNEX which are shown to DYNEX ’s reasonable satisfaction to have been nonconforming or to refund the purchase price, or, if not paid, to a credit amount of the purchase price therefor.

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Sales Offices

Please contact your nearest sales office for accessories, technical assistance or information on product servicing.

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